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CONTRIBUTIONS FROM THE GRAY HERBARIUM
OF HARVARD UNIVERSITY.

No. CVI.

1. Studies in the *Bromeliaceae*.—VI.

By Lyman B. Smith

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STUDIES IN THE BROMELIACEAE—VI

By Lyman B. Smith

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1. Preliminary Records

Studies during the past year have resulted in the discovery of several novelties and cases of previously unnoted synonymy, which are put on record here preliminary to a revision of the genera involved.

In preparing the present paper, I have had the good fortune to receive coöperation from a large number of individuals and institutions as is shown by the following list of exsiccatae citations: the Gray Herbarium of Harvard University (G), the Unites States National Museum (US), the New York Botanical Garden (NY), the Brooklyn Botanic Garden (Brooklyn), the Field Museum of Natural History (FM), the Missouri Botanical Garden (Mo), the private herbarium of Prof. L. H. Bailey of Ithaca, New York (Bailey), the University of Michigan (Mich), the University of California (UCal), the Dudley Herbarium of Stanford University (DH), Pomona College (Pom), the Royal Botanic Gardens at Kew (K), the British Museum of Natural History (BM), the University of Cambridge (Cam), the Riks Museum at Stockholm (S), the Botanical Museum of Copenhagen (Ko), the Herbarium of the Botanical Museum at Berlin-Dahlem (B), the Botanical Museum of Munich (Mun), the Rijks Herbarium of Leiden (Ldn), the Muséum National d'Histoire Naturelle at Paris (P), the National Museum of Prague (Prague), the Conservatory of Botany at Geneva (Gen), the Barbey-Boissier Herbarium (Bo), the Herbarium of the Royal Botanic Gardens of Trinidad and Tobago (Trin), the Herbarium of the Botanic Garden of Rio de Janeiro (JB Rio), the National Museum at Rio de Janeiro (MN Rio), the Biological Institute of São Paulo (SP), the private herbarium of Don Cornelio Osten of Montevideo, Uruguay (Ost), the National Museum of Natural History of Buenos Aires (BA), the National Museum at Santiago, Chile (Chile).

I am particularly indebted to Mr. N. Y. Sandwith, Mr. J. E. Dandy, Prof. H. Harms, Don Cornelio Osten and Dr. Alberto Castellanos for critical notes on certain species.

Billbergia decora Poepp. & Endl. Nov. Gen. ii. 42, t. 157 (1838). *B. boliviensis* Bak. Brom. 81 (1889).

PERU: LORETO: province of Maynas near Yurimaguas, *Poeppig 2432* (Gen, TYPE COLLECTION; phot. G); Yurimaguas, lower Rio Huallaga, alt. 135 m., 1929, *Killip & Smith 27646* (G, US, FM); JUNIN: Pichis Trail, Yapas, alt. 1350–1600 m., 1929, *Killip & Smith 25609* (US). BOLIVIA: LA PAZ: Unduavi, alt. 2600 m., 1885, *Rusby 2853* (NY, type of *B. boliviensis;* phot. G).

The type of *Billbergia boliviensis* closely resembles *B. decora* in the shape and size of its sepals as well as in other characters, and nothing remains as a basis for separating the two.

Canistrum perplexum, spec. nov., floriferum ad 4 dm. altum: foliis rosulatis, patentibus, ad 5 dm. longis; vaginis late ellipticis, ad 15 cm. longis, dense minuteque castaneo-lepidotis; laminis lingulatis, 4–5 cm. latis, late rotundatis apiculatisque, minute serrulatis, dissite perobscureque lepidotis: scapo erecto, 4 mm. diametro, dense umbrino-lanato; scapi bracteis late ellipticis, apiculatis, roseis, adpresse lepidotis, unica prope basin scapi, reliquis cyathidium sub inflorescentiam formantibus; inflorescentia percompacte bipinnatim paniculata, 5 cm. longa, 6–7 cm. diametro, dense umbrino-lanata; bracteis primariis late ovatis, mucronatis, integris, quam spicae brevioribus, membranaceis, nervatis: spicis densissimis, paucifloris; bracteis florigeris primariis similibus sed angustioribus, quam sepala paulo brevioribus: floribus sessilibus, 3 cm. longis; sepalis liberis, ellipticis, mucronatis, 19 mm. longis, paulo asymmetricis; petalis lingulatis, obtusis, apiculatis, 20 mm. longis, caeruleis, a ligulis binis elongatis filamenta involventibus auctis; staminibus petala subaequantibus; ovario ellipsoideo, tubo epigyno 2 mm. longo; placentis loculorum ad apicem versus lineatim affixis; ovulis obtusis. Pl. I, figs. 12–15.

BRAZIL: SÃO PAULO: Jardim Botanico, São Paulo, 1934, *Hoehne 31550* (G, TYPE; SP); Alto da Serra, alt. 800–900 m., 1929, *L. B. Smith 1969* (G).

In its coloration and indument this species closely resembles *Canistrum roseum*, but it is smaller and more slender in habit and the appendages on the petals are connate for their entire length. This type of appendage is discussed further on under *Hohenbergia*.

Guzmania Hitchcockiana, spec. nov., florifera metralis (Hitchcock!): foliis ligulatis, 1 m. vel ultra longis, 6 cm. latis, acuminatis, supra glabris, subtus dense minuteque brunneo-lepidotis: scapo ignoto: inflorescentia ample laxeque bipinnata, dense brunneo-lepidota; bracteis primariis inferioribus anguste triangularibus, quam rami axillares subduplo brevioribus: spicis ad 13 cm. longis, longe stipitatis; bracteis florigeris late ovatis, obtusis, 12 mm. longis, sublaevibus, nullo modo carinatis: floribus subpatentibus, crasse pedicellatis, solum fructiferis cognitis; sepalis oblongis, late obtusis, dense lepidotis, ca. 20 mm. longis, ad 10 mm. connatis; petalis staminibusque ignotis. Pl. I, fig. 1.

ECUADOR: GUAYAS: Teresita, 3 km. west of Bucay, alt. 270 m., 1923, *Hitchcock 20436* (US, TYPE; phot. G, NY).

This species is most nearly related to *G. Scherzeriana* Mez from which it differs in its dense brown indument.

Hechtia Meziana, spec. nov., florifera ut videtur fere metralis: foliis ad 8 dm. longis, angustissime triangularibus, 3 cm. latis, utrinque dense adpresseque ferrugineo-lepidotis, spinis ad 6 mm. longis armatis, apice longe attenuatis et inermibus: scapo elongato, gracili, ca. 7 mm. diametro, glabro; scapi bracteis parvis, maxime remotis, ex ovato acuminatis, chartaceis, roseis: inflorescentia perlaxe bipinnatim paniculata, 4 dm. longa et 15 cm. diametro, rosea, glaberrima; bracteis primariis eis scapi similibus, quam bases steriles ramorum subduplo brevioribus; ramis gracilibus, laxe florigeris: bracteis florigeris ovatis, acutis, pedicellos aequantibus vel superantibus, membranaceis: floribus pedicellis usque ad 3 mm. longe stipitatis, femineis solum cognitis; sepalis late triangulari-ovatis, acutis, 4 mm. longis, chartaceis; petalis ovato-lanceolatis, acutis, 9–10 mm. longis, pulchre roseis; filamentis 4–6 mm. longis, antheris abortivis; ovario glabro, stylo brevissimo. Pl. I, figs. 2–3.

MEXICO: CHIAPAS: Rocky banks, ravines near Monserrate, 1925, *Purpus 10276* (NY, TYPE; phot. G).

Hechtia Desmetiana is probably the nearest relative of this species, but differs in having large foliaceous scape-bracts and leaves glabrous above.

Hohenbergia Schult. f. As first conceived, *Hohenbergia* was composed of very diverse elements and it was not until Mez's treatment in the Flora Brasiliensis[1] that it was made homogeneous by taking *H. stellata* as typical and excluding the remainder of the species originally proposed. Later treatments bring the number of species to about thirty, but all follow Mez's definition closely and the limits of *Hohenbergia* may be considered as reasonably well settled.

On the other hand, the position of *Hohenbergia* relative to the other members of the *Bromelioideae* is debatable. Mez and Harms have placed it among the genera characterized by naked petals, although both admit the presence of so-called calli on the petals of *H. stellata* and certain other species. Apparently their stand is that these structures are essentially simple, amounting to little more than slight

[1] Mez in Mart. Fl. Bras. iii. pt. 3, 263 (1891).

thickenings of the petal and not comparable with such structures as the nectar-scales in *Aechmea*.

On the contrary these structures of *Hohenbergia* are among the most complex in the family, and are equaled in development only in *Gravisia*, *Ananas*, and possibly some species of *Billbergia*. The illustration of the petal of *H. inermis* (Pl. I, fig. 4) shows that these "calli" are in reality slenderly infundibuliform nectar-scales with the side next the petal much produced upward and finally free so that the scale often appears double. I have observed this same structure in *H. caymanensis*, *H. penduliflora*, and *H. Urbaniana*. In *H. spinulosa*, I have found the scales without the upward prolongation, and in *H. eriostachya* and *H. portoricensis* the long ridges but no pockets. This latter type is apparently the one found in *H. stellata* to judge by illustrations. It seems likely that the basic form of the appendage is that illustrated by *H. inermis* and that the other two have evolved from it by reduction.

Hohenbergia should be placed among the genera of the *Bromelioideae* with appendaged petals. It is most nearly related to *Gravisia* which has the identical petal-structure. E. Morren has illustrated this well for *Gravisia exsudans* in Belgique Horticole, xxix. t. 18, although under the name *Hohenbergia exsudans*. In fact no distinction remains between the two genera except the form of the pollen.

Hohenbergia caymanensis Britton in herb., spec. nov., foliis magnis, ca. 8 cm. latis, apice acumine lato brevique imposito optime rotundatis, margine spinis parvis vix 1 mm. longis praeditis, utrinque e lepidibus brunneis minutissime puncticulatis: scapo ca. 8 mm. diametro, e lepidibus ferrugineis dense furfuraceo, vaginis lineari-lanceolatis lepidotis membranaceis minute serrulatis fere omnino obtecto: inflorescentia sublaxe bipinnata, 4 dm. longa, ubique ferrugineo-lepidota; bracteis primariis eis scapi similibus, infimis spicas axillares bene superantibus: spicis densis, ellipsoideis, 3 cm. longis, supremis breviter, infimis ad 2 cm. stipitatis; bracteis florigeris ad 12 mm. longis, e basi triangulari-ovata in setam subaequilongam productis, valde nervatis, supremis sterilibus: floribus ad 14 mm. longis; sepalis liberis, 6 mm. longis, valde asymmetricis, apice in spinam maximam subaequilongam pallidam productis; petalis ex sicco caeruleis, 10 mm. longis, oblongo-lanceolatis, valde acutis, ligulis binis, nectaria profunda angustissime obconica formantibus, apice in vaginam elongatam grosse serratam et cum petalo maxime connatam excurrentibus; staminibus inclusis, seriebus II cum petalis alte connatis; ovulis obtusis. Pl. I, figs. 5–6.

GRAND CAYMAN: 1890–91, *J. T. Rothrock 495* (NY, TYPE; phot. G).

This species is most nearly related to *H. spinulosa* Mez but differs in having the spikes stipitate.

Hohenbergia negrilensis Britton in herb., spec. nov., e fragmentis solum cognita, florifera ut videtur ultra metralis: foliis maximis, crasse coriaceis; laminis ligulatis, 15 cm. latis, apice rotundatis et triangulari-apiculatis, spinis vix 1 mm. longis armatis, supra glabra, subtus dense adpresseque pallido-lepidotis: scapo ca. 7 mm. diametro; scapi bracteis lineari-lanceolatis, acuminatis, densissime imbricatis, chartaceis, pallidis: inflorescentia elongato-thyrsoidea, densissime bipinnatim paniculata, ultra 5 dm. longa, 1 dm. diametro; bracteis primariis eis scapi similibus, perelongatis, infimis spicas axillares triplo superantibus, supremis quam spicae subduplo brevioribus; spicis omnibus sessilibus, suberectis vel patentibus, cylindricis, ad 6 cm. longis, 2 cm. diametro: bracteis florigeris spinula excepta 2–3 mm. longis, 5 mm. latis, latissime acutis vel rotundatis, apice spinula ad 4 mm. longa armatis, plus minusve nervatis; floribus fructiferis 9 mm. longis; petalis staminibusque ignotis; sepalis perasymmetricis, ca. 5 mm. longis, brevi-mucronulatis, pallido-lepidotis; ovario triangulato, appresse pallido-lepidotis. Pl. I, figs. 7–8.

JAMAICA: Vicinity of Negril, 1908, *Britton & Hollick 2023* (NY, TYPE; phot. G).

Owing to the age of the material any indument there may have been on the axes has disappeared. In habit this species resembles *H. spinulosa* Mez but the floral bracts are much shorter and the mucros of the sepals are very short.

Hohenbergia stellata Schult. f. in R. & S. Syst. vii. 1251 (1830). *H. oligosphaera* (Bak.) Mez in DC. Mon. Phan. ix. 124 (1896). *Aechmea oligosphaera* Bak. Brom. 48 (1889). Pl. I, fig. 9.

Hohenbergia oligosphaera has been separated from *H. stellata* on the basis of having unequal sepals and calli on the petals. An examination of the type of *H. stellata* in the Munich Herbarium shows that the anterior sepal is distinctly shorter than the two posterior ones, and it has already been noted that living material of the species shows appendages on the petals. Thus no distinction remains between the two species and the later *H. oligosphaera* must lapse.

Mezobromelia, gen. nov., foliis integris: floribus quaquaverse ordinatis, hermaphroditis; sepalis symmetricis; petalis intime conglutinatis, intus biligulatis; filamentis cum petalis connatis; ovario supero.

Mezobromelia bicolor, spec. nov., verisimiliter acaulis, florifera fere 5 dm. alta: foliis ad 45 cm. longis, utrinque minutissime perobscureque lepidotis; vaginis ovatis, extus castaneis; laminis ligulatis, acutis, 25 mm. latis: scapo erecto, gracili; scapi bracteis erectis, densissime imbricatis, foliaceis sed supremis fulgide rubris: inflorescentia laxe bipinnatim paniculata, 12 cm. longa; axe glabro, sulcato; bracteis primariis latissime ovatis, fulgide rubris, perobscure lepidotis, infimis longe acuminatis, spicas superantibus, supremis apiculatis, quam spicae bene brevioribus: spicis breviter stipitatis, ellipsoideis, compacte 3–5-floris; rhachi brevi sed distincta; bracteis florigeris oblongo-lanceolatis, late acutis, ad 16 mm. longis, quam sepala brevioribus, ad apicem carinatis, glabris, chartaceis, valde nervatis: floribus subsessilibus; sepalis aequaliter subliberis, oblongo-lanceolatis, late acutis, 18 mm. longis, carinatis, glabris, nervatis; petalis lingulatis, obtusis, 20 mm. longis, citrinis (Killip!), a ligulis binis triangularibus alte insertis auctis; staminibus inclusis, stylum subaequantibus, filamentis cum petalis alte connatis vel conglutinatis. Pl. I, figs. 10–11.

COLOMBIA: EL VALLE: epiphytic, bushy summit of west peak, La Cumbre, alt. 2100–2400 m., 1922, *Killip 11396* (G, TYPE).

In this genus the structure of the corolla is exactly like that in *Guzmania* except that there are scales alternating with the filaments at their point of attachment to the corolla.

Through the kindness of Mr. A. L. Delisle in preparing microtome sections of *Mezobromelia* and of *Guzmania monostachia*, I have been able to compare the relation of petals in the two in great detail. In neither is the corolla truly gamopetalous, but the petals are so folded and interlocked as to make it seem so even in fresh material (cf. Bot. Mag. t. 5220, fig. 2). In cross-section the edge of one petal appears forked or split and enfolds the filament and the edge of the adjacent petal.

It is a great pleasure to dedicate this genus to Dr. Carl Mez, who has done more than any other botanist to clarify the taxonomy of the *Bromeliaceae*.

Neoregelia bahiana (Ule), comb. nov. *Nidularium bahianum* Ule, Engl. Bot. Jahrb. xlii. 195 (1908). *Aregelia bahiana* Mez, Engl. Pflanzenr. [Heft 100] iv. fam. 32, 42 (1934).

BRAZIL: SÃO PAULO: Alto da Serra, 1933, *Hoehne 31170* (SP, phot. G).

The species is already known from Minas Geraes as well as from Bahia.

Neoregelia carcharodon (Bak.), comb. nov. *Karatas carcharodon* Bak. Brom. 12 (1889). *Nidularium carcharodon* E. Morr. ex Bak. l. c. *Karatas macracantha* Bak. l. c. 8, nomen. *Aregelia carcharodon* Mez in DC. Mon. Phan. ix. 78 (1896).

Neoregelia tristis (Beer), comb. nov. *Bromelia tristis* Beer, Brom. 30 (1857). *Nidularium triste* Regel, Gartenfl. xv. 356 (1866). *Karatas tristis* Bak. Brom. 5 (1889). *Regelia tristis* Lindm. in Öfvers. Akad. Holm. 542 (1890). *Aregelia tristis* Mez in DC. Mon. Phan. ix. 68 (1896).

Pitcairnia kniphofioides, spec. nov., caulescens, florifera ad 75 cm. alta: foliis dimorphis, alteris e vagina triangulari-ovata setiformibus, badiis, margine validissime spinosis, alteris foliaceis, saturate caeruleo-viridibus (Lehmann!), ad 3 dm. longis, subpetiolatis, basi spinosis, laminis late lanceolatis, acuminatis, 4 cm. latis, glabris: scapo erecto, brunneo-floccoso; scapi bracteis supremis ovato-lanceolatis, acutis, glabris, quam internodia bene brevioribus: inflorescentia simplicissima, dense spicata, 12 cm. longa, glabra: bracteis florigeris ovatis, acutis, 2 cm. vel ultra longis, membranaceis, ante anthesin stricte erectis, dense imbricatis et flores obtegentibus, per anthesin deciduis: floribus per anthesin reflexis, subsessilibus; sepalis lanceolatis, late acutis, 15 mm. longis, nullo modo carinatis; petalis quam sepala paulo longioribus, caeruleo-albis, nudis; ovario ad 2/3 supero. Pl. I, fig. 18.

COLOMBIA: CAUCA: terrestrial in damp woods, above Arrayanal on the Rio Ritaralda, alt. 2000 m., 1883, *Lehmann 3310* (Bo, TYPE; phot. G).

Except for the inflorescence from which this species derives its name, it strongly resembles *Pitcairnia nigra*. Its petals, however, are naked.

Puya lasiopoda, spec. nov., e fragmento inflorescentiae solum cognita, florifera verisimiliter magna: inflorescentia laxe bipinnata, tomentoso-lepidota; bracteis primariis ovatis, minutissime serrulatis, submembranaceis, ex sicco rubris, quam rami axillares bene brevioribus sed partem sterilem ramorum excedentibus: racemis spiciformibus densis, ellipsoideis, ad 10 cm. longis et 5 cm. latis, longe graciliterque stipitatis; bracteis florigeris eis primariis similibus sed minoribus integrisque, sepala subaequantibus: floribus erectis, pedicellis graciliter obconicis, ad 7 mm. longis; sepalis anguste lanceolatis, 45 mm. longis, apice uncinatis, nullo modo carinatis; petalis angustissime ellipticis, acutis, 6 cm. longis, ex sicco atro-violaceis; stylo staminibusque elongatis, petala subaequantibus vel post anthesin paulo exsertis; ovulis obtusis. Pl. I, figs. 16–17.

BOLIVIA: EL BENI: Reis, alt. [500 m., 1886, *Rusby 2232* (NY, TYPE; phot. G).

In the character of its indument and texture of its bracts and sepals this species closely resembles *Puya stenothyrsa* (Bak.) Mez, but its sepals are nearly twice as large, the floral bracts are relatively much narrower, and the spikes are much denser. The axes are much more tomentose than the bracts, making a noticeably sharp contrast.

In the size and form of its spikes, floral bracts and sepals it resembles *P. oxyantha*, but unlike that species it has spikes that have long slender stipes.

Puya Rusbyi (Bak.) Mez in DC. Mon. Phan. ix. 482 (1896); Mez in Engl. Pflanzenr. [Heft 100] iv. fam. 32, 297 (1935). *Pitcairnia Rusbyi* Bak. Brom. 122 (1889). *Puya Kuntzeana* Mez in DC. Mon. Phan. ix. 490 (1896); Mez in Engl. Pflanzenr. [Heft 100] iv. fam. 32, 308 (1935).

BOLIVIA: La Paz: near La Paz, alt. 3300 m., 1885, *Rusby 2846* (NY, TYPE; phot. G); Cochabamba: Tunari, alt. 1300 m., 1892, *Kuntze* (NY, type of *Puya Kuntzeana;* phot. G).

In identifying *Puya Kuntzeana* with *P. Rusbyi*, its characteristics, so well defined by Mez, obviate a detailed description of the latter species. *P. Rusbyi* has been misunderstood heretofore because its original description was drawn from *Rusby 2850* as well as from the type. *Rusby 2850* is *P. alpestris*, a native of central Chile. It is labelled as from Bolivia, but as Rusby collected in central Chile in the year that this specimen was gathered, it seems probable that a mixture of labels occurred.

Puya sanctae-crucis (Bak.), comb. nov. *Pitcairnia sanctae-crucis* Bak. Brom. 120 (1889). *Puya floccosa* E. Morr. sensu Mez in DC. Mon. Phan. ix. 478 (1896); Mez in Engl. Pflanzenr. [Heft 100] iv. fam. 32, 294 (1935), quoad plantas bolivianas, non E. Morr. (1889). *Pitcairnia robusta* Rusby, Bull. N. Y. Bot. Gard. vi. 488 (1910). Pl. II, fig. 1.

BOLIVIA: La Paz: Songo, 1890, *Bang 892* (G, NY, FM, Mo, BM, Bo); Apolo, alt. 1600 m., 1902, *R. S. Williams 2655* (NY, type of *Pitcairnia robusta;* phot. G); Santa Cruz: 1847, *Castelnau* (P, TYPE; phot. G).

In *Puya sanctae-crucis* the indument is deciduous at an early stage, not persistent as in *P. floccosa*. The flowers are much more distinctly pedicellate in *P. sanctae-crucis*, and the whole plant is much more like *P. Pearcei* than it is like *P. floccosa*.

Quesnelia Lamarckii Bak. Brom. 85 (1889). An examination of the type of this species in the Smithian Herbarium of the Linnean Society shows that it must be reduced to the synonymy of *Musa coccinea* Andr.

Tillandsia (§ **Allardtia**) **Cardenasii**, spec. nov., caulescens, florifera 20–25 cm. alta: caule ad 1 dm. longo, simplici: foliis erectis vel suberectis, dense polystiche ordinatis, ad 2 dm. longis; vaginis ovatis, 5 mm. longis, glabris, chartaceis; laminis lineari-triangularibus, filiformi-acuminatis, basi 8 mm. latis, dense villoseque cinereo-lepidotis, involutis: scapo erecto, 1 mm. diametro, glabro, sulcato; scapi bracteis lanceolatis, internodia superantibus, atro-purpureis, adpresse lepidotis, infimis foliaceo-laminatis: inflorescentia foliis paulo superata, simplicissima, dense 4–7-flora, in circuitu lanceolata, complanata, 5 cm. longa, 1 cm. lata; bracteis florigeris eis scapi similibus sed glabris, dense imbricatis, submembranaceis, nullo modo carinatis, ad 27 mm. longis, sepala superantibus: floribus immaturis solum cognitis, brevissime pedicellatis; sepalis liberis, lanceolatis, acuminatis, ad 20 mm. longis, glabris, nervatis; petalis lingulatis, lilacinis (Cardenas!); staminibus stylum subaequantibus, quam petala paulo brevioribus: capsulis cylindricis, breviter rostratis, bracteas florigeras subaequantibus. Pl. III, figs. 5–6.

BOLIVIA: CHUQUISACA: rocky places, Cerro Macho, alt. 2730 m., 1933, *Cardenas 491* (G, TYPE).

Tillandsia caribaea, nom. nov. *T. Fendleri* Mez in DC. Mon. Phan. ix. 741 (1896), non Griseb. (1865).

Tillandsia (§ **Platystachys?**) **lepidosepala**, spec. nov., saepe pulvinata, acaulis vel subacaulis: foliis rosulatis, ad 15 cm. longis, dense pruinoseque cinereo-lepidotis; vaginis late ovatis vel suborbicularibus, nullo modo inflatis, 10–15 mm. longis; laminis erectis vel patentibus, lineari-triangularibus, acuminatis, basi 7 mm. latis, involutis: scapo brevi, foliis fere abscondito; scapi bracteis erectis, foliaceis, densissime imbricatis, inflorescentiam subaequantibus: inflorescentia fructifera solum cognita, simplicissima, dense 2–5-flora, foliis superata; bracteis florigeris lanceolatis, acutis, 20–35 mm. longis, sepala aequantibus vel superantibus, quam internodia 3–4-plo longioribus, submembranaceis, nullo modo carinatis, densissime cinereo-lepidotis: floribus sessilibus; sepalis liberis, lanceolatis, acuminatis, ad 20 mm. longis, valde nervatis, dense lepidotis, lateralibus carinatis; petalis genitalibusque ignotis: capsulis cylindricis, breviter rostratis, bracteas florigeras subaequantibus. Pl. II, figs. 2–3.

MEXICO: HIDALGO: near Tula, 1905, *Rose, Painter & Rose 8283* (US); MICHOACAN: on trees near Lake Cuitzco, 1892, *Pringle 5323* (G, TYPE); PUEBLA: Teocalli de Cholula, alt. 2224 m., 1907, *Arsène 1846* (US); Malintze, 1910, *Nicolas 5742* (US).

This species has until now been confused with *T. Ehrenbergiana*, from which it differs in its nearly acaulescent habit and very densely imbricate foliaceous scape-bracts.

Tillandsia Reichenbachii Bak. Brom. 166 (1889). *T. tucumanensis* Mez in DC. Mon. Phan. ix. 853 (1896). *T. Herzogii* Wittm. Mededell. Rijks Herb. xxix. 89 (1916).

BOLIVIA: Santa Cruz: "monte" near Cumbarute, alt. 800 m., 1910, *Herzog 1151* (Ldn, type of *T. Herzogii;* B, phot. G); Charagua, alt. 800 m., 1934, *Cardenas 2682* (G). ARGENTINA: Jujuy: San Pedro de Jujuy, alt. 600 m., 1925, *Schreiter 153* (G, Ost, BA); 1926, *Venturi 5326* (G, FM, Mo); Salta: dept. Guachipas, Alemania, alt. 1300 m., 1929, *Venturi 9883, 10018* (G); Tucuman: sketch of living plant in Hamburg gardens brought from Tucuman (K, type; phot. G); Barranca Colorada near Tucuman, 1873, *Lorentz & Hieronymus* (B, type of *T. tucumanensis;* phot. G); Quebrada de San Rafael, 1918, *Schreiter 27/2349* (G, BA); Campo Alegre, alt. 400 m., 1922, *Schreiter 802* (Ost); dept. Burroyacu, Cerro del Campo, alt. 800 m., 1928, *Venturi 7759* (G, Mo).

Although *Tillandsia Reichenbachii* is based only on a crude sketch, there seems to be sufficient evidence to establish its identity. The sketch shows a plant with a short stem, polystichous leaves, and large suborbicular petal-blades. This immediately reduces the possibilities in Tucuman, the type locality, to two species, *T. Duratii* and one that has been going under the name of *T. tucumanensis. T. Duratii* has circinnate leaves that are much stouter than those of *T. tucumanensis.* The sketch of *T. Reichenbachii* definitely shows the fine filiform-acuminate leaves of *T. tucumanensis* which are merely curved and not circinnate. Furthermore, material of so-called *T. tucumanensis* gathered in Tucuman, *Venturi 7759*, shows that plants with compound and simple inflorescences may occur in the same collection. Thus it is evident that *T. Reichenbachii* must include the later *T. tucumanensis.* The identity of *T. Herzogii* with *T. Reichenbachii* has been overlooked heretofore because of the scant knowledge of the latter species, and probably also because the types came from different countries.

2. Synopsis of the Tribe Tillandsieae. Part 2.

The following installment of the synopsis consists of a revision of those species of *Tillandsia* which have a simple distichous- or single-flowered inflorescence and caulescent habit. Such a treatment is necessarily somewhat artificial in character, cutting across several of the natural sections of *Tillandsia* in order to achieve its primary aim of providing a rapid key for fruiting material. Yet about half of these species belong to the sections *Phytarrhiza* and *Diaphoranthema* between which the transition is so gradual that they may be considered as presenting a solid block of species. The unrelated elements come from *Allardtia, Anoplophytum* and *Platystachys.*

It should be understood here that I have changed the typification of *Anoplophytum*, making its transversely plicate filaments diagnostic, and have reduced the sections *Pityrophyllum* and *Aerobia* to *Platy-*

stachys and *Allardtia* respectively. *Pityrophyllum* is not tenable because the break between a paniculate inflorescence with few-flowered distichous spikes and one of a single polystichous-flowered spike is no stronger here than it is within the sections *Allardtia* and *Anoplophytum*. *Tillandsia brachycaulos* Schdl., for instance, may have either type of inflorescence according to the vigor of its growth, just as may *T. biflora* R. & P. of the section *Allardtia*. *Aerobia* supposedly had more deeply included stamens than *Allardtia*, but in checking the latter I find that there is every degree of transition from barely included to deeply included stamens.

In addition to the natural groupings included, the plants in this revision derive a unity of their own from certain characters corollary to their caulescent habit. In all the species, for example, the leaf-blades are relatively thick and are either linear or narrowly triangular, never lingulate. In most cases they are plants of distinctly xerophytic habitat and have the scales on the leaves strongly developed.

The distinction between simple and compound inflorescences is an extremely convenient one in handling fruiting material. In the large majority of cases a given species is limited to one category or the other, being what we might term "obligate-simple" or "obligate-compound." In a small proportion of cases, a species while normally of one type may at times be the other, or what may be termed "facultative-simple" or "facultative-compound." In the latter case the species is treated in the part of the synopsis dealing with its normal state, but is keyed in parenthesis in the part dealing with its facultative state.

In citing material certain specimens are cited on the authority of others when it has not been possible for me to examine them personally and where the species are well marked and generally agreed upon. In such cases the authority and an exclamation mark are enclosed in parenthesis immediately following the specimen.

Certain species of this revision are so common that it has been necessary to abridge their bibliography and the citation of their specimens but in all cases the really significant literature is given and enough specimens are cited to illustrate the present knowledge of their distribution.

Key to Species

1. Spikes with flowers distichous or secund, or else the inflorescence reduced to a single flower.
   2. Sepals asymmetric, free, oblong or broadest near the apex, not over 10 mm. long.................... *Tillandsia* § *Pseudo-Catopsis*.[1]

[1] Contrib. Gray Herb. lxxxix. 15 (1930).

2. Sepals symmetric, or if slightly asymmetric, ovate or lanceolate, broadest near the base.
   3. Inflorescence of a single spike or reduced to a single flower, either terminal or pseudoaxillary.
      4. Plant caulescent: leaf-blades linear or triangular. *Tillandsia* in part.
         5. Leaves polystichous.
            6. Leaves much more than 15 mm. long: plant not at all moss-like.
               7. Scape-bracts more than 2 when the scape is present, always concealing the greater part of the scape and usually imbricate.
                  8. Inflorescence more than 2-flowered, usually scapose.
                     9. Floral bracts and flowers erect at anthesis, diverging only in so far as they are forced to make room for those directly above them.
                        10. Leaf-blades less than 3 times as long as the barely distinct sheaths, (Cf. pl. III, fig. 1).
                           11. Floral bracts prominently nerved, lepidote.
                              12. Inflorescence scapose: petals blue or violet. Peru................1. *T. cauligera.*
                              12. Inflorescence sessile: petals rose. Peru. 2. *T. Macbrideana.*
                           11. Floral bracts nearly or quite even, glabrous. Argentina..................3. *T. Friesii.*
                        10. Leaf-blades many times longer than the usually distinct sheaths. (Cf. pl. III, figs. 2, 5, 7).
                           13. Inflorescence dense: floral bracts nearly or quite twice as long as the internodes.

(*See continuation*)

(*Continuation*)

14. Floral bracts not more than 20 mm. long.
   15. Floral bracts ovate or lanceolate, not (or very minutely) apiculate.
      16. Floral bracts evenly convex, not at all carinate.
         17. Floral bracts equaling or exceeding the sepals.
            18. Sepals glabrous.
               19. Floral bracts merely acute: spike linear or lance-linear in outline. (Cf. pl. II, fig. 4).
                  20. Leaves pungent, appressed- or subpruinose-lepidote.
                     21. Floral bracts glabrous, faintly nerved. Peru, Bolivia............................4. *T. caulescens.*
                     21. Floral bracts densely lepidote, strongly nerved. Brazil.................................5. *T. dura.*
                  20. Leaves with soft filiform-acuminate apices, tomentose-lepidote.
                     22. Leaves abruptly spreading from the base of the blade, widely spaced. Colombia, Peru, Bolivia, Chile...............................18. *T. paleacea.*
                     22. Leaves strict and rather dense. Paraguay..19. *T. arhiza.*
               19. Floral bracts acuminate: spike broadly lanceolate or oblanceolate. (Cf. pl. II, fig. 5). Argentina..12. *T. argentina.*
            18. Sepals densely lepidote. Colombia, Ecuador..13. *T. incarnata.*

17. Floral bracts distinctly shorter than the sepals.
 23. Plants long-caulescent: leaves mostly shorter than the stem.
  24. Leaves abruptly spreading from the base of the blade, widely spaced. Colombia, Peru, Bolivia Chile. 18. *T. paleacea.*
  24. Leaves strict and rather dense. Paraguay...... 19. *T. arhiza.*
 23. Plants short-caulescent: leaves much longer than the stem.
  25. Leaves strongly pruinose- or tomentose-lepidote. Brazil, Peru, Bolivia, Paraguay.......... (*T. streptocarpa.*)[1]
  25. Leaves appressed-lepidote.
   26. Leaf-blades slender, filiform-acuminate, barely if at all circinnate: floral bracts glabrous. Bolivia, Argentina............................ (*T. Reichenbachii.*)[1]
   26. Leaf-blades stout, pungent, strongly circinnate: floral bracts usually lepidote. Bolivia, Paraguay, Uruguay, Argentina...................... (*T. Duratii.*)[1]
16. Floral bracts sharply carinate: flowers often viviparous. Colombia, Ecuador, Peru......................... (*T. latifolia.*)[1]
15. Floral bracts suborbicular, membranaceous, the lower ones long-apiculate. Cuba to northern Argentina.......... (*T. pulchella.*)[2]
14. Floral bracts distinctly more than 20 mm. long.
 27. Sepals densely and persistently lepidote.
  28. Scape-bracts foliaceous: scape very short. Mexico.. (*T. lepidosepala.*)
  28. Scape-bracts or at least the upper ones thin and not at all foliaceous.
   29. Leaf-blades 10–17 mm. wide, flat except near the apex, appressed- or slightly pruinose-lepidote. Colombia, Ecuador.. 13. *T. incarnata.*
   29. Leaf-blades 3 mm. in diameter, involute, villous-lepidote. Mexico................................ 14. *T. Ehrenbergiana.*
 27. Sepals glabrous.
  30. Floral bracts obtuse and often apiculate, membranaceous: inflorescence terete at anthesis: leaf-sheaths suborbicular, not at all auricled. Mexico and the West Indies to Venezuela and Colombia......................... 15. *T. Schiedeana.*
  30. Floral bracts acute or acuminate: inflorescence usually complanate.
   31. Floral bracts all densely and persistently lepidote: scape largely obscured by the leaves. Bolivia.......... (*T. boliviensis.*)
   31. Floral bracts glabrous or the lowest with a few early deciduous scales.
    32. Scape appearing nearly as thick as the inflorescence because of its very densely imbricate bracts: flowers viviparous. Chile......................... 6. *T. Werdermannii.*
    32. Scape appearing distinctly more slender than the inflorescence: flowers never viviparous.
     33. Leaves reflexed-tomentose with very fine elongate scales: leaf-blades only 8 mm. wide at base. Bolivia. 7. *T. Cardenasii.*
     33. Leaves appressed- or coarsely pruinose-lepidote with suborbicular scales.

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[1] Inflorescence normally compound, species to be treated in later article.

[2] Inflorescence typically simple and polystichous-flowered, but a single specimen known, *Wilkes Expedition* (G), from Brazil, with a reduced simple distichous-flowered inflorescence.

34. Stem shorter than the densely massed leaves.
35. Floral bracts not over 40 mm. long: scape always elongate: sepals obtuse.
36. Leaves with soft filiform-acuminate apices: stem very short. Chile................8. *T. Geissei.*
36. Leaves with straight pungent or subpungent apices.
37. Floral bracts rarely more than 25 mm. long: petal-blades narrowly elliptic.
38. Floral bracts prominently nerved: leaves evenly fine-acuminate. Bolivia, Brazil, Paraguay, Argentina...........(*T. Lorentziana.*)
38. Floral bracts even except near apex: leaves gradually narrowed to an abruptly acute apex. Argentina......12. *T. argentina.*
37. Floral bracts 25–40 mm. long: leaves gradually narrowed to an abruptly acute apex: petal-blades large, suborbicular. Uruguay. 9. *T. arequitae.*
35. Floral bracts up to 70 mm. long: scape usually short and concealed by the leaves: petal-blades large, suborbicular. Bolivia, Uruguay, Argentina..............................10. *T. xiphioides.*
34. Stem longer than the few-ranked widely spaced spreading leaves: petal-blades large, suborbicular. Argentina..........................11. *T. diaguitensis.*

13. Inflorescence lax: floral bracts much less than twice as long as the internodes.
39. Plant large, long-caulescent: sepals ca. 20 mm. long. Mexico...........16. *T. albida.*
39. Plant small, short-caulescent: sepals ca. 9 mm. long. Peru, Bolivia, Brazil, Paraguay, Uruguay, Argentina..24. *T. loliacea.*
9. Floral bracts and flowers spreading at anthesis. Ecuador, Peru....................20. *T. caerulea.*
8. Inflorescence 1–2-flowered, sessile. Venezuela. 17. *T. Funckiana.*
7. Scape-bracts not more than 2: scape exposed for most of its length.
40. Floral bracts glabrous: stem not over 6 cm. long.
41. Floral bracts prominently nerved: scape-bracts one or none. Argentina........25. *T. erecta.*
41. Floral bracts even: scape-bracts 2. Bolivia, Argentina.........................26. *T. funebris.*
40. Floral bracts densely appressed-lepidote: stem up to 20 cm. long. Argentina..........36. *T. andicola.*
6. Leaves not more than 15 mm. long: plant resembling a coarse moss or a *Lycopodium.*
42. Scape bracteate throughout: inflorescence usually of several flowers. Bolivia, Brazil, Paraguay, Argentina...........................27. *T. tricholepis.*
42. Scape naked when present or with 1–2 bracts: inflorescence always 1-flowered.
43. Floral bract 1-nerved: leaf-sheaths 3-nerved. Peru, Bolivia, Argentina..............28. *T. bryoides.*

43. Floral bract several-nerved: leaf-sheaths 4–many-nerved.
44. Leaves erect: inflorescence distinctly scapose in most cases. Argentina .... 29. *T. aizoides.*
44. Leaves spreading to recurved: inflorescence subsessile. Argentina .... 30. *T. angulosa.*

5. Leaves distichous.
45. Floral bracts 4–5 cm. long. Argentina ... 11. *T. diaguitensis.*
45. Floral bracts ca. 2 cm. long at most.
46. Stem rarely over 2 dm. long, wholly concealed by the imbricate leaf-sheaths.
47. Leaf-blades narrowly triangular, mucronate, usually well over 2 mm. in diameter.
48. Leaves spreading or recurved.
49. Leaves rarely more than 2 cm. long: scape not over 4 cm. long.
50. Floral bracts and sepals prominently nerved, floral bracts densely lepidote. Argentina .... 30. *T. angulosa.*
50. Floral bracts and sepals nearly or quite even, not more than scantly lepidote. Argentina .... 31. *T. rectangula.*
49. Leaves 2–30 cm. long: scape often elongate.
51. Floral bracts glabrous.
52. Floral bracts and sepals even: leaf-blades strongly angled. Bolivia, Argentina .... 26. *T. funebris.*
52. Floral bracts and sepals prominently nerved: leaf-blades terete. Argentina. 32. *T. Castellani.*
51. Floral bracts densely lepidote.
53. Leaves tomentose-lepidote. Bolivia, Brazil, Uruguay, Argentina .... 21. *T. crocata.*
53. Leaves appressed- or slightly pruinose-lepidote.
54. Stem not over 10 cm. long, usually shorter than the leaves.
55. Leaf-blades laterally compressed: leaf-sheaths indistinct, but little broader than the blades, enfolding the stem only by their extreme base. Peru, Bolivia, Argentina. 33. *T. Gilliesii.*
55. Leaf-blades terete: leaf-sheaths distinct, much broader than the blades, enfolding the stem for most of their length.
56. Sepals equally subfree: scape usually elongate. Bolivia, Uruguay, Argentina .... 34. *T. myosura.*
56. Sepals much connate posteriorly: scape 55 mm. long at most. Argentina .... 35. *T. retorta.*
54. Stem 20 cm. long, many times longer than the leaves: sepals connate posteriorly. Argentina .... 36. *T. andicola.*

48. Leaves erect: sepals connate posteriorly: scape naked. Peru, Bolivia, Paraguay, Argentina, Chile............................39. *T. capillaris.*

47. Leaf-blades linear, usually obtuse, not over 2 mm. in diameter.

57. Sepals free or equally short-connate.

58. Floral bracts glabrous or scantly lepidote, at most barely longer than the internodes. Bolivia, Paraguay, Uruguay, Argentina. 22. *T. bandensis.*

58. Floral bracts densely lepidote, twice as long as the internodes or the inflorescence 1-flowered.

59. Sepals lepidote: 2 or 3 scape-bracts immediately below the first floral bract: stem up to 2 dm. long. Peru, Chile. 37. *T. Landbeckii.*

59. Sepals glabrous, or if lepidote, then only a single scape-bract immediately below the first floral bract.

60. Sepals 12.5 mm. long: petal-blades suborbicular, 6.5 mm. broad, blue or violet. Brazil............23. *T. Mallemontii.*

60. Sepals not more than 9 mm. long, (much shorter within the range of *T. Mallemontii*): petal-blades narrowly elliptic, pale violet or white. Southern United States to Argentina...38. *T. recurvata.*

57. Sepals connate posteriorly: scape without bracts or absent. Peru, Bolivia, Paraguay, Argentina, Chile..................39. *T. capillaris.*

46. Stem several meters in length, exposed between alternating bunches of leaves. Southern United States to Argentina and Chile............40. *T. usneoides.*

4. Plant acaulescent: leaves often ligulate.[1]

3. Inflorescence compound.[1]

1. Spikes with flowers polystichous.[1]

1. **Tillandsia** (§ **Allardtia**) **cauligera** Mez. Plant 45 cm. long: stem simple so far as known, at least 6 dm. long, 5–7 mm. thick: leaves densely polystichous, 21 cm. long, cinereous, densely pruinose-lepidote; sheath 30–45 mm. broad, ovate but merging indistinguishably into the blade, half as long as the blade; blades suberect or slightly secund, triangular, acuminate, rigid, apex often uncinate-recurved, margin undulate: scape distinct, terminal, erect, 3–25 cm. long, from shorter than to much exceeding the leaves; its bracts numerous, densely imbricate, striate-nerved, densely lepidote, the median and lower ones foliose and more or less laminate, the upper ones acute or apiculate and thinner, often bright red: inflorescence usually simple and distichous, occasionally a small second spike;

[1] To be treated in later articles.

primary bract when present shorter than the spike and resembling the scape-bracts; spike lanceolate or linear-lanceolate, acute, complanate, 8–9 cm. long, densely 10–14-flowered; rhachis slightly flexuous, strongly 4-angled, glabrous; floral bracts erect, densely imbricate, 3–4 times as long as the internodes, completely concealing the rhachis, ovate, narrowly obtuse, 20–25 mm. long, exceeding the sepals, not at all carinate, uniformly chartaceous, reddish, lepidote on the apex and margins, striate: flowers short-pedicellate; sepals elliptic, broadly acute or obtuse, 18 mm. long, chartaceous, striate, coarsely sparse-lepidote soon becoming glabrous, connate posteriorly for 3 mm.; petals 37 mm. long, blue, drying violet; stamens and style included.—Saxicolous; Peru.—Mez in Fedde Rep. Spec. Nov. iii. 42 (1906); Harms in Engl. & Prantl, Nat. Pflanzenf. ed. 2, xv a. 119 (1930).—SALVAJINA; OQUENHUEYCONTOY.—Pl. III, fig. 1.

PERU: CAJAMARCA: Hacienda La Tahona, near Hualgayoc, alt. 2600 m., *Weberbauer 4050* (B, TYPE; phot. G); JUNIN: between Tarma and Palca, alt. 2700–3000 m., *Weberbauer 2415* (B); Tarma, alt. 3000–3200 m., 1929, *Killip & Smith 21803* (G, FM, US); CUZCO: Ollantaytambo, alt. 3000 m., 1915, *Cook & Gilbert 568; 785* (US); Cuzco, alt. 3000–3600 m., 1923, *Herrera* (US).

2. **Tillandsia** (§ **Allardtia**) **Macbrideana** L. B. Smith. Plant over 3 dm. long: roots present: stem much branched, also sending out slender stolons with reduced leaves: leaves polystichous, densely imbricate, 3–4 cm. long, densely appressed-lepidote, cinereous; sheath broadly elliptic, 15–20 mm. wide, scarcely distinct from the blade and over half as long; blade triangular, acuminate, recurved near apex: scape lacking: inflorescence terminal, simple and distichous, lanceolate, acute, up to 4 cm. long, 15 mm. broad, 5–10-flowered; rhachis nearly straight, glabrous, sulcate, excavated next the flowers; floral bracts erect, imbricate, 3–4 times as long as the internodes but so narrow as to expose most of the rhachis at anthesis, lanceolate, broadly acute or obtuse, 2 cm. long, exceeding the sepals, not at all carinate, closely striate, submembranaceous, at first densely appressed-lepidote, later glabrous, chartaceous, rose: flowers subsessile; sepals narrowly lanceolate, strongly carinate, glabrous, striate, connate posteriorly for 5 mm.; petals 25 mm. long, narrowly elliptic, obtuse, rose; stamens slightly longer than the style, emerging from the throat of the corolla but shorter than the petals, anthers very narrow, 7 mm. long, filaments straight; ovary 3 mm. long, ovoid: fruit not known, possibly not developed and the species propagating solely by stolons. —Saxicolous; Peru.—L. B. Smith in Contrib. Gray Herb. lxxxix. 11, t. 2, figs. 1–3 (1930).

PERU: HUANUCO: on eastern face of rock cliffs, Llata, alt. 2100 m., *Macbride & Featherstone 2258* (FM, TYPE; G, COTYPE).

The single old and withered inflorescence at hand shows no evidence of capsules, indicating that the species probably reproduces vegetatively but has not gone so far as *T. Werdermannii* in changing the flower.

In publishing this species I noted the fact that the stamens exceeded the style, and stressed it as indicating some affinity with the section *Anoplophytum.* Since then I have found that this character is of no value in distinguishing *Anoplophytum* from *Allardtia,* and that the really valid distinction of *Anoplophytum* is its transversely plicate filaments.[1]

3. **Tillandsia** (§ **Allardtia**) **Friesii** Mez. Plant distinctly caulescent: stem ca. 15 cm. long, decumbent-ascending: leaves densely polystichous, not at all secund, up to 7 cm. long; sheaths oblong-elliptic, glabrous and enfolding the stem only at the extreme base; blades narrowly triangular, acuminate, 7–9 mm. broad, stiff, complicate toward apex, coarsely cinereous-lepidote throughout, subpruinose, sometimes blackish: scape lacking: inflorescence terminal or axillary, simple, dense, not more than 6-flowered, sessile and about equaling the leaves, sublanceolate, complanate, up to 5 cm. long and 1 cm. broad, glabrous throughout; rhachis slightly flexuous, angled; floral bracts erect, imbricate but so narrow as to expose the rhachis, ovate, broadly acute, ca. 17 mm. long, exceeding the sepals, somewhat rigid, even and slightly lustrous, ecarinate, bright red: flowers subsessile, erect, ca. 20 mm. long; sepals lanceolate, acute, 13 mm. long, chartaceous, even or faintly nerved, free; petals purple (Fries!), bright red when dry, obtuse, forming a slightly flaring tube; stamens included, shorter than the pistil.—Saxicolous; northern Argentina.—Mez in Fedde Rep. Spec. Nov. iii. 37 (1906). Pl. II, fig. 11.

ARGENTINA: SALTA: Tambo in Quebrada del Toro, alt. 3000 m., *R. E. Fries 828* (S, TYPE; phot. G).

4. **Tillandsia** (§ **Allardtia**) **caulescens** Brongn. Plant up to 45 cm. long: roots present even in age: stem much branched, up to 30 cm. long: leaves very numerous, densely polystichous, rigid, strict or arching and secund, 10–15 cm. long, densely appressed- or subpruinose-lepidote throughout; sheath subtriangular, several times shorter than the blade; blade narrowly triangular, ca. 5 mm. broad at base, acuminate, involute, pungent, usually with a strong median ridge below: scape distinct to almost none, usually much obscured by the leaves,

[1] L. B. Smith in Ostenia, 360 (1933); Proc. Am. Acad. lxviii. 149 (1930).

terminal, straight or curved; its bracts densely imbricate, the lower ones foliose, the upper ones elliptic, acute or apiculate, nerved, roseate, more or less lepidote: inflorescence always simple and distichous, linear or lance-linear in outline, acute, strongly complanate, up to 14-flowered, 5–7 cm. long, 10–12 mm. wide; rhachis slightly geniculate, strongly 4-angled, glabrous; floral bracts erect, densely imbricate, over 3 times the length of the internodes, but partially exposing the rhachis, ovate-lanceolate, acute, 15–20 mm. long, exceeding the sepals, convex, not at all carinate, subcoriaceous, faintly nerved, glabrous, roseate: flowers subsessile, 25 mm. long; sepals lanceolate, acute, 15 mm. long, glabrous, even or faintly nerved, equally subfree or connate posteriorly up to 3 mm.; petals lingulate, white, spreading at anthesis; stamens emerging from the throat of the corolla, shorter than the style; ovary ovoid-pyramidal.—Peru, Bolivia.—Brongn. ex Bak. Brom. 168 (1889); Mez in DC. Mon. Phan. ix. 811 (1896); F. L. Herrera, Est. Fl. Dep. Cuzco, 76 (1930). Pl. II, fig. 4.

PERU: Cuzco: near Ollantaitambo, province of Urubamba, alt. 2900 m., 1925, *F. L. Herrera 825* (US, G, FM); Indefinite: *C. Gay 1186* (P, type; phot. G); Quebrada Versalles, *A. Diehl 2451* (FM). BOLIVIA: La Paz: vicinity of Bopi River Valley, alt. 1000 m., 1921, *Rusby 670* (NY); vicinity of Huachi, head of Beni River, alt. 600 m., 1921, *O. E. White 536* (NY); same, alt. 500 m., *O. E. White 1068* (NY, phot. G).

5. **Tillandsia** (§ **Allardtia**) **dura** Bak. Plant 2–4 dm. long: roots present even in age: stem almost always simple, from very short to about 14 cm. long: leaves very numerous, polystichous, strict or somewhat arching and often secund, 15–23 cm. long, densely and finely appressed-lepidote throughout, becoming subglabrous above with age, chestnut-brown for the entire length of the sheath and much of the blade, the remainder pale gray-green in the dried material; sheath ovate, scarcely more than 1 cm. long, passing imperceptibly into the blade; blade narrowly triangular, up to 11 mm. broad at base (Mez!) but usually much narrower, rigid, subulate-acuminate: scape distinct but usually much obscured by the leaves, terminal, slender, erect or ascending; its bracts many, densely imbricate, ovate, thin, densely and finely appressed-lepidote, the median and lower ones with stiff leaf-like blades: inflorescence always simple and distichous, the spike linear, acute, strongly complanate, 14–26-flowered, 7–13 cm. long, 10–14 mm. wide; rhachis slightly geniculate, sulcate, angled, distinctly excavated next the flowers, glabrous; floral bracts erect, strongly imbricate, often 3 times the length of the internodes, but so narrow as partially to expose the rhachis, ovate, acute, apiculate,

17–20 mm. long, exceeding the sepals, subchartaceous, strongly nerved, densely appressed-lepidote toward apex, grooved at base, rounded or carinate toward apex, straight or slightly incurved: flowers subsessile; sepals free or equally short-connate or at times the posterior ones connate for about half their length, 8–11 mm. long, oblong-lanceolate, acute, strongly nerved, glabrous, the posterior ones carinate; petals lingulate, blue, 17 mm. long; stamens included, anthers linear, acute, 5 mm. long, dorsifixed 1/4–3/5 of their length from the base; pistil exceeding the stamens, ovary slenderly ovoid.—Saxicolous and epiphytic; Brazil.—Bak. Brom. 168 (1889); Mez in Mart. Fl. Bras. iii. pt. 3, 584, t. 108 (1894); Mez in DC. Mon. Phan. ix. 811 (1896); Harms in Engl. & Prantl, Nat. Pflanzenf. ed. 2, xv a. 119 (1930). *T. linearis* Vell. sensu Wawra, Oesterr. Bot. Zeitschr. xxx. 221 (1880); It. Sax.-Cob. i. 174 (1883), non Vell. (1825).

BRAZIL: FEDERAL DISTRICT: Rio de Janeiro, Pico da Tijuca, *Glaziou 16460* (K, TYPE; phot. G); 1929, *L. B. Smith 2126* (G, S, B); *Wawra II, 223* (Mez!); *Binot* (Mez!); Rio de Janeiro, Serra da Carioca, alt. 460–720 m., 1928, *L. B. Smith 1280* (G, FM, US, K, BM); SÃO PAULO: on trees by shore, São Vicente, Santos, 1875, *Mosén 3716* (S, phot. G); Ribeirão Pires, 1894, *Edwall in hb. S. P. 12390* (G, SP); epiphytic in matto, Estação Biologica, Alto da Serra, alt. 800–900 m., 1929, *L. B. Smith & J. King 1933* (G).

In *Tillandsia* as a rule the character of sepal fusion is a fairly constant and reliable one, but in *T. dura* it fails to hold. The *Edwall* specimen, while closely simulating the rest of the material in all other regards, has the posterior sepals fused for about half their length. All other numbers have the sepals nearly or quite free.

T. dura seems to be more nearly related to *T. caulescens* than to any other species. It resembles *T. caulescens* quite closely in habit and dimensions but has the floral bracts densely lepidote instead of glabrous.

6. **Tillandsia** (§ **Allardtia?**) **Werdermannii** Harms. Plant at least 5 dm. long, probably much longer: roots lacking (Werdermann!): stem procumbent, at least 2 dm. long, much branched, some of the branches or axillary shoots apparently breaking away and serving to propagate the species vegetatively: leaves densely polystichous, 15–20 cm. long, densely cinereous-lepidote, subpruinose; sheaths barely discernible, mostly less than 3 cm. long; blades suberect, narrowly triangular, 10–15 mm. broad at base, channeled, involute-subulate, rigid, often somewhat contorted: scape terminal, 20–30 cm. long or more, ca. 4 mm. thick, glabrous; its bracts erect, numerous, densely imbricate, lanceolate, acute or acuminate, 5–8 cm. long, subcoriaceous, nerved, appressed-lepidote: inflorescence simple and distichous, 25 cm.

long combined with the scape from which it is difficult to distinguish it in the extremely old material at hand, linear, ca. 2 cm. broad; rhachis flexuous, strongly flattened and angled, glabrous; floral bracts like the scape-bracts but glabrous, ca. 4 cm. long, 3–4 times as long as the internodes, much exceeding the sepals, erect, densely imbricate, completely concealing the rhachis, not at all carinate: flowers very short-pedicellate; sepals free, linear-lanceolate, broadly acute, 22–25 mm. long, glabrous; petals many and stamens and pistil aborted as apparent beginning of viviparous flower.—Terrestrial; Chile.—Harms in Notizbl. x. 218 (1928).—Pl. III, fig. 4.

CHILE: Tacna: above Tacna, alt. 800–1200 m., 1925, *Werdermann 717* (B, type; G, Mun, FM, Mo).

A single flower found on the Gray specimen is quite evidently infertile, indicating that the species has adapted itself to its environment along the same lines as has *T. latifolia* in coastal Peru.

Werdermann's informative note made at the time of collection may be translated as follows: "Lying loose on the ground, without roots and with only last year's or isolated very young and undeveloped inflorescences. Forming large pure stands, so that the masses on the pure sand appear gray from a long distance."

7. **Tillandsia** (§ **Allardtia**) **Cardenasii** L. B. Smith (see p. 154). Caulescent, flowering plant 20–25 cm. high: stem up to 1 dm. long, simple: leaves erect or suberect, densely polystichous, up to 2 dm. long; sheaths ovate, 5 mm. long, glabrous, chartaceous; blades linear-triangular, filiform-acuminate, 8 mm. wide at base, densely villous-lepidote with basally produced cinereous scales, involute: scape erect, 1 mm. in diameter, glabrous, sulcate; scape-bracts lanceolate, exceeding the internodes, dark purple, appressed-lepidote, the lowest foliaceous-laminate: inflorescence slightly exceeded by the leaves, simple, densely 4–7-flowered, lanceolate in outline, complanate, 5 cm. long, 1 cm. wide; floral bracts like those of the scape but glabrous, densely imbricate, submembranaceous, not at all carinate, up to 27 mm. long, exceeding the sepals: flowers known only in immature or in fruiting condition, subsessile; sepals free, lanceolate, acuminate, up to 20 mm. long, glabrous, nerved; petals lingulate, lilac (Cardenas!); stamens about equaling the style, slightly shorter than the petals: capsule cylindric, short-beaked, about equaling the floral bracts. Pl. III, figs. 5–6.

BOLIVIA: Chuquisaca: rocky places, Cerro Macho, alt. 2730 m., 1933, *Cardenas 491* (G, type).

8. **Tillandsia** (§ **Allardtia**) **Geissei** Phil. Plant 22–60 cm. high

and probably up to nearly 1 m., acaulescent or very short-caulescent: roots present: stem simple, not over 5 cm. long: leaves polystichous, spreading, 1–3 dm. long, much shorter than the inflorescence, densely appressed-cinereous-lepidote throughout; sheath ovate, many times shorter than the blade and merging imperceptibly with it, the same color as the blade or with a faint brownish tinge; blade narrowly triangular, filiform-acuminate, 7–12 mm. broad at base, soft and relatively thin, usually twisted toward apex: scape terminal, erect, slender, up to 4 dm. long, equaling or exceeding the leaves, glabrous; its bracts numerous, densely imbricate, densely cinereous-lepidote, the lower foliaceous, the upper lanceolate, apiculate, tinged with red like the floral bracts: inflorescence simple and distichous or unequally bifurcate with a lateral spike 12 cm. long; primary bract like the scape-bracts, much shorter than the lateral spike; single or principal spike linear-lanceolate, acute, 8–17 cm. long, 6–14-flowered; rhachis sharply 4-angled, less than 2 mm. thick, slightly flexuous, glabrous; floral bracts erect, imbricate, about 3 times as long as the internodes, concealing the rhachis until after anthesis, lance-ovate, acute, 30–35 mm. long, exceeding the sepals, 12–14 mm. wide, sparsely cinereous-lepidote becoming glabrous with age, not at all carinate, nerved, uniformly chartaceous, brilliantly variegated with red, green and yellow: flowers subsessile; sepals free, lanceolate, obtuse, 25 mm. long, glabrous, thin; petals 30 mm. long, linear with blade scarcely distinct, obtuse, rose-purple; stamens included; ovary slenderly ovoid, stigma short: capsule cylindric, 3–4 cm. long.—Epiphytic; Chile.—R. A. Philippi in Gartenfl. xxxviii. 369, t. 1302, figs. II–IIf (1889); Rev. Hort. lxi. 388 (1889).

CHILE: ANTOFAGASTA: Dept. Taltal, on stems of *Cereus* on ridges in upper part of fertile belt, vicinity of Aguada de Miguel Diaz, ca. 24° 35′ S. lat., 1925, *I. M. Johnston 5320* (G); ATACAMA: on *Cereus*, near Caldera, 1887, *W. Geisse* (Chile, TYPE; phot. G).

It is rather surprising to find this species, with its thin flat leaves and apparent preference for epiphytism, in the arid regions of northern Chile, where types like *T. Werdermannii* are much more to be expected.

9. **Tillandsia** (§ **Allardtia**) **arequitae** André. Flowering plant up to 4 dm. high, often subpulvinate: roots present: stem conspicuous, usually branching several times, decumbent for most of its length, ends of the branches ascending: leaves numerous, erect to recurved, densely polystichous, not at all secund, up to 20 cm. long (Mez!) but generally not much more than half that length, densely cinereous-lepidote throughout, pruinose; sheaths indistinct, densely imbricate, making

the stem appear very stout; blades narrowly triangular, acuminate up to the abruptly acute pungent apex, 15 mm. broad, stout, rigid, keeled below, complicate toward apex: scape erect, conspicuous, ca. 1 dm. long, usually exceeding the leaves; its bracts densely imbricate, narrowly elliptic, acute, greenish stramineous, at least the lower ones lepidote: inflorescence always simple, lanceolate, acute, complanate, up to 10 cm. long without the petals, densely 6–12-flowered; rhachis flexuous, 4-angled, narrowly alate, glabrous; floral bracts erect, densely imbricate and concealing the rhachis, 3 times as long as the internodes, narrowly triangular-ovate, acute, 25–40 mm. long, exceeding the sepals, rather thin, glabrous, slightly nerved, greenish with stramineous nerveless margins, ecarinate: flowers subsessile; sepals linear-lanceolate, obtuse, 21 mm. long, submembranaceous, glabrous, equal, free; petals ca. 5 cm. long, white, odorless, claw linear, blade spreading, suborbicular, ca. 18 mm. wide, obscurely crenate or entire; stamens elongate, barely included or exserted from the throat of the corolla, shorter than the pistil, anthers linear, 7 mm. long; pistil exserted, ovary prismatic: capsule not known.—Terrestrial and epiphytic; Uruguay.—André ex Mez in DC. Mon. Phan. ix. 814 (1896); Herter, Florula Urug. 45 (1930); Harms in Engl. & Prantl, Nat. Pflanzenf. xv a. 119 (1930). *T. xiphioides* var. *arequitae* André in Rev. Hort. lxv. 156, cum icon. (1893).

URUGUAY: MINAS: *Arechavaleta 2613 bis; Gibert; Tweedie 1120* (Mez!); Cerro de Arequita, 1890, *André K 320* (K, TYPE; G, FM).

In Osten's herbarium there is a plant collected in Paraguari, Paraguay, by Rojas, which is very close to this species. However, the petals are blue and the scape very short, and Sr. Osten informs me that the data on the label is not wholly reliable. Consequently I am waiting for more material to appear before noting a range extension for *T. arequitae* or describing the Rojas plant as a novelty.

I am much indebted to Sr. Osten for a series of photographs illustrating this species in general growth and in detail.

10. **Tillandsia** (§ **Allardtia**) **xiphioides** Ker-Gawl. Flowering plant from 15 to over 30 cm. high: roots present: stem from very short to 15 cm. long, simple or few-branched: leaves numerous, polystichous but sometimes almost distichous, erect to spreading, more or less curved or contorted, up to 25 cm. long but often very much shorter, densely cinereous- or ferrugineous-lepidote throughout, pruinose; sheaths large, densely imbricate, making the stem appear 1–2 cm. thick, passing imperceptibly into the blade; blade narrowly triangular, subulate-acuminate, flat and up to 2 cm. wide at base:

scape from practically none to 12 cm. long but always much obscured by the upper leaves, erect; its bracts elliptic-oblong, densely imbricate and completely concealing the scape, thin, the lower ones caudate and lepidote, the upper apiculate and nearly or quite glabrous: inflorescence always simple and distichous, lance-oblong, acute, up to 12 cm. long without the petals, 2–10-flowered; rhachis up to 3 mm. thick, 4-sided, narrowly alate, flexuous, glabrous; floral bracts densely imbricate, usually several times longer than the internodes, lance-oblong, acute, up to 7 cm. long, much exceeding the sepals, ca. 14 mm. wide, submembranaceous, prominently nerved with a broad scarious nerveless margin, glabrous or sometimes the lower ones sparsely lepidote, stramineous or suffused with red or violet, ecarinate: flowers sessile, erect, up to 10 cm. long; sepals linear-lanceolate, acuminate, up to 42 mm. long, free, glabrous, submembranaceous, prominently nerved; petals white, fragrant, claw linear, blade broadly elliptic, obtuse, spreading, ca. 2 cm. wide, conspicuously crenate-serrate; stamens elongate, barely included or exserted from the throat of the corolla, shorter than the pistil and much shorter than the petals, filaments filiform, straight, anthers linear, 8 mm. long; pistil exserted, style slender, ovary slenderly prismatic: capsule stout, abruptly short-beaked, 3 cm. long.—Saxicolous and epiphytic; Bolivia, Uruguay and northern Argentina.—Ker-Gawl. in Bot. Reg. ii. t. 105 (1816); Spreng. Syst. ii. 23 (1825); R. & S. Syst. vii. 1200 (1830); Hook. in Bot. Mag. xcii. t. 5562 (1866); Benth. & Hook. Gen. iii. 670 (1883); Bak. Journ. Bot. xxv. 214 (1887); Brom. 164 (1889); Mez in DC. Mon. Phan. ix. 813 (1896); Kuntze, Rev. Gen. iii. 304 (1898); Hicken, Chloris Plat. 62 (1910); Memmler in Gartenwelt, xvii. 718 (1913); Hauman & Vanderveken, Phan. L'Arg. i., in An. Mus. Nac. Hist. Nat. B. A. xxix. 248 (1917); Herter, Florula Urug. 45 (1930); Harms in Engl. & Prantl, Nat. Pflanzenf. ed. 2, xv a. 119 (1930); Castellanos, Brom. & Cact. in Physis, x. 90 (1930); Brom. Arg. iii., in An. Mus. Nac. Hist. Nat. B. A. xxxvi. 375 (1931); iv., in xxxvii. 509 (1933). *Anoplophytum xiphyoides* Beer, Brom. 254 (1857), nomen. *Tillandsia macrocnemis* Griseb. Symb. Argent. in Goett. Abh. xxiv. 332 (1879); Spegazzini, Fungi Argent. 322 (1899). *T. xiphoides* E. Morr. ex Wittm. in Engl. & Prantl, Nat. Pflanzenf. ii. Abt. 4, 57 (1888). *T. odorata* Gill. ex Bak. Journ. Bot. xxv. 214 (1887), in synonymy. *T. sericea* Hort. ex Bak. ibid. *T. suaveolens* Lem. ex Bak. ibid. *Phytarhiza xiphioides* E. Morr. ex Bak. ibid. *T. unca* Griseb. sensu Hicken, Physis, i. (1912), non Griseb. (1874). *T. Friesii* Mez sensu Castellanos, Brom. Arg. iv., in An. Mus. Nac. Hist. Nat. B. A. xxxvii. 501, t. 1 (1933), non Mez (1906).—Flor del aire (Argentina).

BOLIVIA: Potosi: prov. Nor-Chichas, on rocks near San Antonio, 1931, *Cardenas 93* (G). URUGUAY: San José: on rocks, Sierra de Mahama, *Larriera* (Ost, phot. G). ARGENTINA: Jujuy: Volcan, 1927, *Castillon 6613* (Castellanos!); Salta: *Rodriguez 6610* (Castellanos!); Cafayate, 1913, *Rodriguez 1252* (G, BA); Tucuman: La Hoyada, 1920, *Schreiter 1377* (G, BA); Las Arcas, 1920, *Schreiter 1099* (Castellanos!); near Baco, dept. Trancas, alt. 900 m., 1920, *Venturi 1316* (Ost); Sierra de la Candelaria, dept. Trancas, alt. 950 m., 1924, *Venturi 2495a* (G); dept. Tafi, Colalao del Valle, 1931, *Schreiter 7176* (Castellanos! as *T. Friesii* emend.); Catamarca: Piedra Blanca, 1908, *Castillon 6612* (Castellanos!); Andalgalá, 1915, *Jörgensen 6611* (Castellanos!); 1916, *1105* (Castellanos!); Santiago del Estero: 1913, *Wagner* (Castellanos!); La Rioja: Los Llanos, 1895, *Bodenbender* (Castellanos!); Sierra Velasco near La Rioja, *Hieronymus & Niederlein 9* (Mez!); San Juan: 1904, *Spegazzini* (Castellanos!); Córdoba: near Córdoba, 1879, *Lorentz 123* (G, BM); *Hieronymus 912* (US, FM); *423; Kurtz 1153; 4822* (Mez!); 1891, *Kuntze* (NY); Rio Primero, Sierra de Córdoba, 1874, *Hieronymus* (NY); Dean Funes, 1916, *Sanzin 1156* (Ost); Los Paredones near Capilla del Monte, Sierra Chica, alt. 1000 m., 1918, *Osten 13465* (Ost); 1923, *Osten 17114* (Ost); Sierra Grande, Cerro Áspero, 1922, *Castellanos 1204* (Castellanos!); San Luis: Sierra del Morro, 1913, *Pastore* (Castellanos!); Mendoza: near Mendoza, 1825, *Gillies* (G, BM, Cam); 1879, *Miers 640* (BM); Cacheuta, 1913, *Sanzin 276* (Ost).

According to Castellanos all reports of this species from Buenos Aires are based on introduced material.

The type can not be located at Kew, the British Museum or Cambridge and it seems probable that no specimen was preserved. Fortunately the plate accompanying the original description is unmistakable.

11. **Tillandsia** (§ **Allardtia**) **diaguitensis** Castellanos. Plant much slenderer and more elongate than either *T. xiphioides* or *T. arequitae:* stem up to 6 dm. long, 5 mm. in diameter, simple or few-branched: leaves evenly and laxly polystichous along the stem or distichous (Castellanos!), 8–10 cm. long, densely cinereous-lepidote throughout, furfuraceous; sheaths elliptic, amplexicaul, ca. 13 mm. wide, imbricate, making the stem appear 7–10 mm. thick; blades erect to recurved, narrowly triangular, acuminate, ca. 6 mm. wide, strongly nerved when dry, channeled along the upper face: scape terminal, conspicuous, up to 8 cm. long; its bracts imbricate and concealing it, elliptic, acute, thin, stramineous, strongly nerved, lepidote toward apex: inflorescence always simple, spike lanceolate, acute, 4–9 cm. long, 14 mm. broad, densely 3–6-flowered; rhachis slender, nearly straight, glabrous, strongly sulcate; floral bracts imbricate, 2 to 3 times as long as the internodes, lanceolate, acute, 4–5 cm. long, much exceeding the sepals, chartaceous and strongly nerved with a scarious nerveless margin, glabrous, roseate: pedicels 3 mm. long; sepals oblong-lanceolate, acute, 32 mm. long, membranaceous, strongly nerved, glabrous, free: petals ca. 7 cm. long, white or bluish, fragrant,

claws linear, forming a tube well beyond the sepals, blades spathulate, minutely denticulate; stamens 51 mm. long including the 8 mm. long anthers, exserted from the throat of the corolla; pistil 55 mm. long, ovary 7 mm. long, stigma 3-parted: capsule equaling or shorter than the floral bracts.—Saxicolous and epiphytic; northwestern Argentina. —Castellanos, Brom. Arg. ii., in An. Mus. Nac. Hist. Nat. B. A. xxxvi. 55, t. 10 (1929); iv., in xxxvii. 501 (1933).

ARGENTINA: JUJUY: Volcán, 1920, *Castillon 7224* (hb. Castellanos, TYPE); SALTA: dept. San Carlos, Quebrada de Amblayo, 1927, *Schreiter 6585* (Castellanos!); TUCUMAN: dept. Tafi, Las Arcas to Tiopunco, 1917, *Schreiter 809* (Ost); Las Arcas, 1927, *Schreiter 5524* (Castellanos!); same, alt. 2000 m., *Venturi 8670* (G); dept. Trancas, Cadillal to Tapia, alt. 700 m., 1920, *Venturi 1395* (US).

Castellanos describes the leaves as distichous but illustrates them as polystichous. In all the material that I have seen so far they are far from distichous also.

12. **Tillandsia** (§ **Anoplophytum**) **argentina** C. H. Wright. Often pulvinate, flowering plant up to 13 cm. high: stem short but usually distinct, simple or few-branched, up to 8 cm. long (Mez!): roots present: leaves densely polystichous, often secund-curved, up to 13 cm. long but the lower ones much reduced; sheaths triangular, merging imperceptibly into the blades, thin, at least the lower half glabrous and lustrous; blades erect or suberect, very narrowly triangular or linear, abruptly acute, pungent, rigid, channeled above, obtusely carinate below, angular-subulate, 3–6 mm. wide: scape from practically none to 6 cm. long, exceeded by the leaves, erect or ascending, glabrous; its bracts imbricate and concealing it, lanceolate, acuminate, stramineous, chartaceous, strongly nerved, glabrous: inflorescence always simple, broadly lanceolate or oblanceolate, strongly complanate, up to 45 mm. long and 15 mm. wide, 4–7-flowered, glabrous throughout; rhachis nearly straight, strongly 4-angled; floral bracts lanceolate, acuminate, up to 25 mm. long, exceeding the sepals, subcoriaceous, even or somewhat nerved, ecarinate, red, sublustrous: flowers erect, subsessile; sepals narrowly lance-triangular, acuminate, 12–18 mm. long, free, subequal; petals narrow with scarcely distinct suberect to spreading blades, ca. 30 mm. long, obtuse, entire, bright rose-red; stamens ca. 20 mm. long, deeply included, shorter than the pistil, filaments thickened and transversely plicate, anthers linear, 5 mm. long; ovary subprismatic: capsule 20 mm. long, cylindric, beaked.—Saxicolous and epiphytic; northern Argentina.— Kew Bull. 60 (1907). *T. unca* Griseb. sensu Bak. Journ. Bot. xxv. 234 (1887); Brom. 165 (1889); Mez in DC. Mon.

Phan. ix. 812 (1896); Kuntze, Rev. Gen. iii. 304 (1898); Hauman & Vanderveken, Phan. L'Arg. i., in An. Mus. Nac. Hist. Nat. B. A. xxix. 248 (1917); Castellanos, Brom. Arg. i., in Com. Mus. Nac. Hist. Nat. B. A. ii. 144 (1925); Harms in Engl. & Prantl, Nat. Pflanzenf. ed. 2, xv a. 119 (1930); Castellanos, Brom. Arg., iv., in An. Mus. Nac. Hist. Nat. B. A. xxxvii. 508 (1933), non Griseb. (1874).—Pl. II, figs. 5–7.

ARGENTINA: JUJUY: dept. Ledesma, Sierra de Calilagua, alt. 750 m., 1927, *Venturi 5359* (US); SALTA: dept. Guachipas, Alemania, alt. 1300 m., 1929, *Venturi 9978* (G); TUCUMAN: dept. Capital, Barranca Colorada, alt. 550 m., 1920, *Venturi 993* (Ost, BA); dept. Famailla, Rio Leales, alt. 450 m., 1923, *Venturi 2494* (G); Rio Lules, alt. 450 m., 1923, *Schreiter 797 in part* (Ost); Tapia, Cadillal, alt. 500 m., 1918, *Schreiter 797 in part* (Ost); Tapia, 1920, *Venturi 1033* (US); CÓRDOBA: Cosquin to Santa Maria, Sierra de Córdoba, *Hieronymus 346* (FM); Sierra de Córdoba, *Berg* (Mez!); *Hieronymus* (NY, BM); north of Cuesta de Copina, Sierra Achala de Córdoba, 1878, *Hieronymus* (NY); Desempeñadero to San Roque, 1881, *Hieronymus* (US, NY, phot. G); Ochoa, Punilla, 1903, *Stuckert* (K, TYPE; phot. G); Los Paredones near Capilla del Monte, Sierra Chica, alt. 1000 m., 1918, *Osten 13464* (Ost); Rio Pintos, Sierra Chica, alt. 1000 m., 1918, *Osten 13492* (Ost); CATAMARCA: Cuesta de Chilca, *Lorentz 252* (Mez!).

Baker, Mez, Castellanos and Harms have all considered this species as identical with *T. unca* Griseb., but none of them cite the type of *T. unca* and I have not been able to locate it as yet either. However, there is ample evidence in the original description to prove that true *T. unca* is nearly related to if not identical with *T. pulchella* Hook.

Venturi 1315 from Barranca Colorado, Tucuman, combines the characters of *T. argentina* and of *T. ixioides*, which have both been collected from that locality. The hybridizing of *T. argentina* with a species of *Anoplophytum* and its possession of plicate filaments make it seem logical to include it in that section. Such action means that *Anoplophytum*, like *Allardtia* and *Platystachys*, must include both simple distichous and simple polystichous types of inflorescence and must be characterized by the form of its filaments.

13. **Tillandsia** (§ **Anoplophytum**) **incarnata** HBK. Plant attaining a length of 65 cm. and probably much more (no complete specimens have been seen in herbaria), growing in dense masses (André! Lehmann!): roots not noted, probably lacking: stem branching, attaining at least 4 dm.: leaves densely polystichous, 8–18 cm. long, densely cinereous-lepidote, scales appressed or slightly pruinose; sheath ovate, scarcely distinguishable from the blade and several times shorter, sometimes tinged with brown; blades suberect to spreading, narrowly triangular, filiform-acuminate, 10–17 mm. broad at base, usually involute toward apex: scape terminal, straight or slightly

curving, ca. 2 mm. thick at base, lepidote or glabrous, 1–4 dm. long, much exceeding the leaves; its bracts numerous, densely imbricate, elliptic, chartaceous, densely cinereous-lepidote, roseate, the lower ones with long filiform blades, the upper ones acute or apiculate: inflorescence simple and distichous, lanceolate, acute, 5–9 cm. long, 10–17 mm. wide, complanate, 5–12-flowered, often 1 or 2 sterile flowers at apex; rhachis nearly straight, sharply 4-angled, lepidote; floral bracts erect and imbricate or the lowest slightly divergent, 3–4 times as long as the internodes, elliptic, apiculate, 20–25 mm. long, exceeding the sepals, not at all carinate, chartaceous, densely appressed-lepidote, strongly nerved, roseate: flowers subsessile; sepals elliptic-lanceolate, acute, ca. 14 mm. long, prominently nerved, profusely lepidote, connate posteriorly for about half their length; petals narrowly elliptic, obtuse, 20–25 mm. long, erect or nearly so, rose; stamens distinctly shorter than the petals, filaments dilated above and transversely plicate, anthers 4–5 mm. long, subfiliform, acute, sagittate at base; pistil about equaling the stamens, ovary slenderly ovoid: capsule up to 25 mm. long, subprismatic, abruptly short-beaked, dehiscing to the base.—Terrestrial, saxicolous or epiphytic (André!); Colombia, Ecuador.—Nov. Gen. i. 291 (1816); Spreng. Syst. ii. 24 (1825); R. & S. Syst. vii. 1208 (1830); Dietr. Syn. ii. 1057 (1840); André in Belg. Hort. xxvii. 219 (1877); Wittm. in Engl. Bot. Jahrb. xi. 64 (1889); Bak. Brom. 170 (1889); André, Brom. André, 77 (1889); Mez in DC. Mon. Phan. ix. 809 (1896); Harms in Engl. & Prantl, Nat. Pflanzenf. ed. 2, xv a. 119 (1930). *Platystachys incarnata* Beer, Brom. 264 (1857). *Tillandsia striata* Willd. ex R. & S. Syst. vii. 1209 (1830), in synon. *T. brevifolia* Bak. in Journ. Bot. xxv. 239 (1887).—Pl. II, figs. 8–10.

COLOMBIA: NORTE DE SANTANDER: Pamplona, *Funck & Schlim 1479* (BM); between Mutiscua and Pamplona, alt. 2500 m., 1927, *Killip & Smith 19767* (G, US, NY); CUNDINAMARCA: between Bogotá and La Mesa, *Goudot* (Mez!); Facatativa, alt. 2750 m., 1875, *André 604 in part* (K, NY); Salto de Tequendama, alt. 2500 m., 1876, *André 604 in part* (K, NY); 1925, *Schultze 71* (US); Quetame, alt. 100–500 m., 1930, *E. P. Arbelaez 4* (US); Bogotá, alt. 2640 m., *B. G. Amórtegui 175* (US); NARIÑO: La Galera Volcano, near Pasto, alt. 3200 m., 1876, *André 604 in part* (K). ECUADOR: IMBABURA: banks of the Rio Chota, alt. 1670 m., 1876, *André 604 in part* (K, NY); PICHINCHA: banks of the Rio Guallabamba, 1802, *Humboldt & Bonpland* (HBK!); Valley of Turubamba, between Magdalena and Chillogallo, *Firmin 265* (US, FM); LEON: Cotopaxi, *Wagner 92* (Mez!); TUNGURAHUA: near Ambato, 1802, *Humboldt & Bonpland* (HBK!); dry sterile valleys, near Riobamba, Ambato, Tacunga, Guallabamba, etc., alt. 1800–2300 m., 1880, *Lehmann 147* (US, BM); *147 a* (Mez!); Ambato, *Pearce* (K); same, alt. 2600 m., 1923, *Hitchcock 21705* (G, US, NY); CHIMBORAZO: "province of Riobamba," *Rimbach 121* (G, US); AZUAY: between Oña and Cuenca, alt. 2700–

3300 m., 1923, *Hitchcock 21610* (G, US, NY); INDEFINITE: 1855, *Couthouy* (G); interandine highland, alt. 2800 m., 1932, *Rimbach 78* (G).

Mez[1] cites *Humboldt & Bonpland 3138* from S. Felipe, yet a photograph of this number from Paris and another from Berlin-Dahlem disclose no locality at all on the label. The original description[2] reads: "Crescit ad fluvium Guallabamba et prope Hambato Quitensium, ..." Sprague[3] lists no S. Felipe in Humboldt's route in Colombia, the country where Mez cites it, but Sandwith[4] lists it in Peru far to the south of the proved range of *Tillandsia incarnata.* Thus there is every indication that Mez's citation is due to some misunderstanding.

It is impossible to tell now to which of the two localities in the original description the type should be assigned. Neither is it evident which of these is represented by the specimen at Paris or by that at Berlin-Dahlem.

As shown by *Rimbach 121*, *Tillandsia incarnata* has filaments that are dilated and transversely plicate near the apex, and for this reason I consider it a member of the section *Anoplophytum* in the same way that *T. argentina* is.

14. **Tillandsia** (§ **Platystachys**) **Ehrenbergiana** Kl. Flowering plant 10–20 cm. high: roots present: stem simple or branched, 3–5 cm. long, much exceeded by the leaves: leaves densely polystichous, up to 15 cm. long, densely cinereous-villous with fine scales which are produced basally into long narrowly triangular lobes; sheaths broadly elliptic, distinct from the blades, the lower part membranaceous, glabrous, strongly nerved; blades mostly spreading or reflexed, involute-subulate, filiform-acuminate, 3 mm. in diameter: scape terminal, erect or ascending, less than 1 mm. in diameter, strongly sulcate, glabrous; its bracts imbricate, involute, much exceeding the internodes, lanceolate, acuminate, thin, strongly nerved, roseate, lepidote, the lower laminate: inflorescence always simple, elliptic, terete to strongly complanate, 35 mm. long, 16 mm. wide, densely 3–8-flowered; rhachis slender, nearly straight; floral bracts imbricate and concealing the rhachis, 3 to 4 times as long as the internodes, lanceolate, acute, 26 mm. long (Mez!), much exceeding the sepals, 8 mm. wide, membranaceous, strongly nerved, roseate, puberulent-lepidote, the upper half distinctly carinate: flowers subsessile; sepals lanceolate, acuminate, up to 17 mm. long, 5 mm. wide, carinate,

[1] Mez in DC. Mon. Phan. ix. 810 (1896).
[2] HBK. Nov. Gen. i. 291 (1816).
[3] Kew Bull. 1926. 23 (1926).
[4] Kew Bull. 1926. 187 (1926).

membranaceous, strongly nerved, lepidote, subfree; petals tubular-erect, probably yellow (Mez!); stamens and pistil exserted (Mez!), ovary ellipsoid: capsule cylindric, acute, 25 mm. long.—Epiphytic; central Mexico.—Kl. ex Bak. Brom. 169 (1889). *T. Ehrenbergii* Kl. ex Beer, Brom. 264 (1857), nomen; Mez in DC. Mon. Phan. ix. 727 (1896); Harms in Engl. & Prantl, Nat. Pflanzenf. ed. 2, xv a. 118 (1930). *Platystachys Ehrenbergii* Beer, Brom. 264 (1857), nomen.—Pl. III, figs. 7–8.

MEXICO: San Luis Potosi: near San Luis Potosi, alt. 2000–2700 m., 1878, *Parry & Palmer 872* (G, US, Mo); Guanajuato (?): Jaral, *Schumann 1513* (US); Hidalgo (?): Rugla, *Ehrenberg 860* (BM, type; G); Federal District: Valley of Mexico City, *Schmitz 228* (BM); Indefinite: *Christy* (Mez!).

T. Ehrenbergiana is the first name for this species to be accompanied by a description and so must stand.

15. **Tillandsia** (§ **Platystachys**) **Schiedeana** Steud. Flowering plant up to 4 dm. long, but usually not much more than 2 dm., often pulvinate: roots present: stem 5–20 cm. long, simple or few-branched: leaves polystichous, varying greatly in density, up to 25 cm. long, densely cinereous- or ferrugineous-lepidote, scales appressed near apex of leaf, pruinose below; sheaths suborbicular, large, densely imbricate and making the stem appear very stout, at least the margin hyaline, glabrous only where covered; blades very narrowly triangular, filiform-acuminate, involute-subulate: scape terminal, erect, shorter than the leaves; its bracts imbricate and concealing it, the lower foliaceous, the upper thinner and usually roseate but usually with a distinct filiform lamina also: inflorescence always simple, distichous or sometimes polystichous at base (Mez!), lanceolate, acuminate at both ends, terete, up to 7 cm. long and 8 mm. in diameter but often less than half as large, densely few-flowered; rhachis nearly straight, slender, strongly sulcate, glabrous; floral bracts densely imbricate and wholly concealing the rhachis, 2–3 times as long as the internodes, elliptic-lanceolate, obtuse or the basal ones minutely apiculate, ca. 30 mm. long and 10 mm. wide, much exceeding the sepals, membranaceous, roseate, strongly nerved, the lower ones appressed-lepidote, the upper ones often glabrous: flowers sessile, up to 46 mm. long; sepals lanceolate, acute, up to 20 mm. long, subcoriaceous, glabrous, even or few-nerved, the posterior ones usually much connate; petals tubular-erect, yellow; stamens and pistil exserted, ovary ellipsoid: capsule cylindric, up to 45 mm. long.—Epiphytic; Mexico and the West Indies to Colombia and Venezuela.—Nomencl. ed. 2, ii. 688 (1841). *T. vestita* Ch. & Schdl. in Linnaea, vi. 52 (1831), non Willd. (1830),

nec Benth.; Schdl. in Linnaea, xviii. 423 (1844); Hemsley, Biol. Centr.-Am. iii. 323 (1884); Bak. in Journ. Bot. xxv. 238 (1887); Brom. 170 (1889); Millspaugh, Field Mus. Pub. i. 12 (1895); Mez in DC. Mon. Phan. ix. 728 (1896); Standley & Calderon, Lista Prelim. Pl. El Salvador, 47 (1925); Standley, Field Mus. Pub. iii. 222 (1930); Harms in Engl. & Prantl, Nat. Pflanzenf. ed. 2, xv a. 118 (1930). *T. flavescens* Mart. & Gal. in Bull. Acad. Brux. x. pt. 2, 118 (1843). *T. caerulea* HBK. sensu Griseb. in Goett. Nachr. 14 (1865), non HBK. *T. Grisebachii* Bak. in Journ. Bot. xxv. 305 (1887); Brom. 188 (1889). *T. Eggersii* Bak. Brom. 170 (1889).—Xeen (Yucatan); Gallito; Chivito (Salvador).—Pl. III, fig. 9.

MEXICO: Baja California: 1886, *McLellan* (US); San Luis Potosi: near Rascon, 1905, *Palmer 684* (US); Sinaloa: near Labradas, 1925, *Ferris & Mexia 5121 A* (DH); Vera Cruz: Actopan to Jalapa, 1829, *Schiede & Deppe* (B, type; BM); Orizaba, *Botteri 329* (G, US); 1855, *Mueller 1239* (G); 1866, *Bourgeau 2103 in part* (G); 1867, *Bilimek 425* (G); 1885, *Gray* (G); 1894, *Nelson 50 c* (US); 1905, *Purpus 1254* (G, FM, Mo); Cordoba, 1866, *Bourgeau 2103 in part* (G, US); 1884, *Carruthers* (BM); Fortin, 1883, *Kerber 295* (US, BM); near Jalapa, alt. 1200–1300 m., 1899, *Pringle 7793* (G, US); *8063* (G, US, FM, Mo, S, BM); Zacuapan, 1909, *Purpus 3764* (G, US, NY, FM, Mo, UCal, BM); 1919, *Purpus 8216* (UCal); *8221* (G, US, Mo); *8222* (G, US, NY, Mo); Nayarit: Pedro Paulo, 1897, *Rose 3324* (US); Hidalgo: Tatipan to Yahualica, alt. 300–900 m., 1891, *Maury 5956* (G); Jalisco: near Zapotlan, 1893, *Pringle 4376* (G, US, FM, Mo, S, BM); Puebla: valley of the Rio Necaxae near Huauchinango, alt. 1100 m., 1932, *Fröderström & Hultén 826* (S); Morelos: near Cuernavaca, alt. 1600 m., 1898, *Pringle 6860* (G, US, FM, Mo, S, BM); Oaxaca: Totolapa to San Carlos, alt. 1000–1200 m., 1895, *Nelson 2544* (G, US); below Jayacatlan, alt. 1100 m., 1895, *L. C. Smith 550* (G); Tabasco: Tenosique, alt. 60 m., 1892, *Beristain 8014* (G); Campeche: Tuxpeña, 1932, *Lundell 1383* (FM); Yucatan: *Johnson 84* (Mez!); *Gaumer 24422* (G, FM); Merida, 1864, *Schott 161* (BM, FM); Izamal, 1885, *Gaumer 427* (G, FM, Mo, US); 1906, *Greenman 402* (G, FM); Silam, 1885, *Gaumer 664* (G, US, FM, Mo); Quintana Roo: Chichankanab, *Gaumer 1767* (G, US, FM, Mo, DH, S, BM, BA); *1914* (G, US, FM, Mo, S). BRITISH HONDURAS: Toledo, 1907, *Peck 944* (G); El Cayo, 1931, *Bartlett 12906* (G); 1933, *Chanek 115* (G); Rio Grande, 1933, *Schipp S 455* (G, FM). GUATEMALA: Peten: Tikal, 1931, *Bartlett 12651* (G); Vaxactun, 1931, *Bartlett 12287* (G); La Libertad, 1933, *Lundell 2517*, *2534* (G); *2592*, *3929* (Mich); Izabal: near Quirigua, alt. 75–225 m., 1922, *Standley 24218* (G, US, Mo, S); *24476* (G, US); *24606* (G, US, FM, Mo); Zacapa: Gualan, alt. 130 m., 1905, *Deam 211* (G); Guatemala: Sanarate, 1905, *Kellerman 4731* (US); Mt. San Antonio, alt. 1465 m., 1906, *Kellerman 5910* (US); Jalapa: Jalapa, 1908, *Kellerman 7867* (FM); Amatitlan: Pacaya, 1890, *J. D. Smith 1958* (G, US); Moran, alt. 1205 m., *Kellerman 4898* (US). SALVADOR: Santa Ana: near Santa Ana, alt. 655–900 m., 1922, *Standley 20411* (G, US); Ahuachapán: Sierra de Apaneca near Finca Colima, 1922, *Standley 20210* (G, US, S); Sonsonate: near Izalco, 1922, *Standley 22179* (G, US); near Sonsonate, alt. 220–300 m., 1922, *Standley 21772* (G, US); San Salvador: Tonacatepeque, 1921, *Calderon 217* (US); near San Salvador, 650–850 m., 1922, *Standley 22673* (G, US); 1923, *Calderon 1506* (US). HONDURAS: Cortez: Lake Yojoa, alt. 700 m., 1934, *Yuncker 4901* (FM). NICARAGUA: *Rothschuh 93* (Mez!); *Wright* (G, US); Chinandega: Realejo, 1903, *C. F. Baker 2086* (G, US, Mo, S);

MANAGUA: southwest slopes of Santiago Volcano, near Masaya, alt. 300–480 m., 1923, *Maxon 7673* (US); near Managua, 1932, *Garnier 682* (US); *781* (G, US). COSTA RICA: *Oersted* (Mez!); ALAJUELA: El Coyolar, alt. 240 m., 1924, *Standley 39997, 40075, 40078* (US); SAN JOSÉ: La Verbena near Alajuelita, alt. 1000–1200 m., 1898, *Tonduz 8953* (US, Bo); 1924, *Standley 32229* (US); Las Pavas, alt. 1070 m., 1924, *Standley 36108* (US); CARTAGO: Finca Las Concavas, alt. 1200–1300 m., 1925, *Standley 41527* (US); Cartago, alt. 1450 m., 1909, *Biolley 17364* (US); lower Rio Turrialba, 1925, *Stork 2450* (FM). CUBA: PINAR DEL RIO: near Sumidero, *Shafer 13822* (US, FM); SANTA CLARA: Trinidad Mountains, 1910, *Britton, Earle & Wilson 4840* (G, US); Pitajones, 1912, *Shafer 12190* (US, Mo); San Blas, La Sierra, alt. 200–330 m., 1930, *Jack 8040* (G, US, FM, S); 1931, *8207* (US); ORIENTE: Yara to Manzanillo, 1912, *Shafer 12366* (US). JAMAICA: *Bertero; Harris 5223* (Mez!). HAITI: Presqu'ile du Nord-Ouest, Port-de-Paix, near Cordier, 1925, *Ekman 3922* (US); near Anse Galette, Gonave Is., 1920, *Leonard 3116* (US); Dept. du Nord, near St. Raphael, alt. 350 m., 1925, *Leonard 7720* (G, US); Dept. l'Artibonite, near Gros Morne, alt. 235 m., 1926, *Leonard 10017 b* (US); near Mole St. Nicolas, 1929, *Leonard 13306* (US). SAN DOMINGO: *Bertero 463* (Mo); *Picarda 180* (Mez!); Llanos de San Rafael, 1887, *Eggers 1806* (K, type of *T. Eggersii;* BM, US); Prov. Barahona, Duvergé, 1911, *Fuertes 894* (G, US, BM); Azua, 1913, *Rose, Fitch & Russell 3893* (US); Prov. Monte Cristy, Dist. Moncion, 1929, *Valeur 148* (US, FM, Mo, S); same, alt. 300–400 m., 1931, *Valeur 794* (US, S). VENEZUELA: near Biscaina, alt. 1000 m., *Fendler 1533* (K, type of *T. Grisebachii*); ARAGUA: Maracay, *Vogl 1075* (Mun); MERIDA: San Juan to El Vegon, 1928, *Pittier 12852* (US, Mo, Mun). COLOMBIA: MAGDALENA: Santa Marta, alt. 260 m., 1898–9, *H. H. Smith 2348* (G).

After being in constant use for over one hundred years, *Tillandsia vestita* has to be replaced by *T. Schiedeana* because of an earlier homonym.

16. **Tillandsia** (§ **Platystachys**) **albida** Mez & Purpus. Flowering plant up to 4 dm. high: stem elongate, much branched: leaves densely polystichous, 12 cm. long, densely pale cinereous-lepidote; sheaths merging imperceptibly into the blades; blades suberect to squarrose, narrowly triangular, long-acuminate, channeled above but not convolute: scape terminal, erect, short but exceeding the leaves; its bracts densely imbricate, bright red, white-lepidote: inflorescence 13 cm. long, 3 cm. wide, laxly 6-flowered; rhachis undulate, angled, glabrous, bright red; floral bracts erect, not at all imbricate nor concealing the rhachis, elliptic, obtuse, up to 21 mm. long, coriaceous, nearly or quite even with a hyaline margin, ecarinate, especially the lower ones appressed-lepidote: flowers erect, with short stout pedicels, 37 mm. long without the genitalia; sepals obtuse, 20 mm. long, coriaceous, glabrous, even, pale green; petals greenish white, obtuse, tubular-erect; stamens and pistil 5 mm. longer than the petals.—Central Mexico.—Mez & Purpus in Fedde Rep. Spec. Nov. xiv. 248 (1916).

MEXICO: HIDALGO: near Ixmiquilpan, *Purpus* (hb. Mez, TYPE).

The material was originally received at Darmstadt and cultivated there, then sent to Königsberg where Mez studied it.

Maury 5748 from Cañadade Meztitlan, Hidalgo, Mexico, (FM, G), has nearly the same habit as this species, but its inflorescence is so imperfect that it can not be identified with certainty unless compared with the type, which I have not examined.

17. **Tillandsia** (§ **Platystachys**) **Funckiana** Bak. Plant up to 3 dm. long, pulvinate: roots present: stem branching, 2–3 mm. in diameter: leaves very densely polystichous, scarcely more than 5 cm. long, densely lepidote throughout with appressed cinereous or brownish scales; sheaths distinct, triangular-ovate, ca. 5 mm. long; blades erect to recurved, linear, 1–2 mm. broad at base, filiform-acuminate, strongly keeled below: scape none: inflorescence terminal, consisting of a single flower or rarely two; floral bract lance-oblong, acute, membranaceous, 1-nerved, glabrous, not more than half as long as the sepals: sepals elliptic-ovate, obtuse, ca. 15 mm. long, chartaceous, even, glabrous, free; petals tubular-erect, up to 44 mm. long, red: stamens and pistil exserted.—Terrestrial and epiphytic; Venezuela. —Bak. Brom. 196 (1889); Mez in DC. Mon. Phan. ix. 730 (1896); R. Knuth in Fedde Rep. Spec. Nov. Beiheft, xliii. 189 (1927).—Pl. IV, fig. 1.

VENEZUELA: MERIDA: Laderas de San Pablo near Merida, alt. 500–700 m., *Funck & Schlim 1258* (BM, TYPE; Bo, Gen, P, Leningrad); El Morro, alt. 1750 m., 1911, *Jahn 78* (US); Laderas de San Pablo, Rio Chama, alt. 600 m., 1922, *Jahn 1088* (G, US, NY); between Estanques and Puente Real, San Juan to El Vegon, alt. 400–1100 m., 1928, *Pittier 12846* (US, NY).

Baker described the inflorescence as 2–3-flowered, while actually it is 1- or very rarely 2-flowered. This discrepancy is probably due to his drawing his description partly from *Anoplophytum brachypodium* which he included as nearly allied. Neither does there seem to be any evidence of the large size of the floral bract, 47 mm., as recorded by Mez. Mr. Dandy in a recent letter confirms my opinion that there is no such large bract to be found on the type at the British Museum.

18. **Tillandsia** (§ **Phytarrhiza**) **paleacea** Presl. Flowering plant 1–7 dm. long: roots present at least in the early stages of development: stem up to 35 cm. long and probably much more, much branched, appearing stout because of the leaf-sheaths: leaves polystichous in relatively few rows and rather widely spaced so that the blade and the upper half of the sheath are clearly visible, cinereous, often becoming fuscous with age, densely tomentose-lepidote; sheaths large, broadly ovate or elliptic, glabrous except on the upper half outside; blades abruptly spreading, irregularly contorted in most cases, narrowly triangular, 4–6 mm. broad at base, involute-subulate, up to

12 cm. long: scape slender, erect, from very short to over 15 cm. long, glabrous or nearly so; its bracts mostly equaling or exceeding the internodes, narrowly elliptic, apiculate, lepidote, the lower ones filiform-laminate: inflorescence always simple and distichous, narrowly lanceolate, acute, complanate, up to 5 cm. long, densely 1–12-flowered; rhachis strongly angled, glabrous, practically straight or slightly geniculate; floral bracts imbricate, about 3 times as long as the internodes, ovate or elliptic, 12–17 mm. long, varying from slightly longer to slightly shorter than the sepals, not at all carinate, prominently nerved, more or less lepidote when young, becoming glabrous with age: flowers subsessile; sepals lanceolate, 10–17 mm. long, free, glabrous; petals with narrow claw and large suborbicular spreading blue or violet blade; stamens deeply included, exceeding the pistil: capsule cylindric, ca. 2 cm. long.—Presl, Rel. Haenke. i. 125 (1827); R. & S. Syst. vii. 1203 (1830); Gay, Fl. Chil. vi. 16 (1853); Phil. An. Univ. Chile, lix. 323 (1881), Cat. Pl. Chil. 279 (1881); Bak. Journ. Bot. xxv. 279 (1887); Brom. 166 (1889); Mez in DC. Mon. Phan. ix. 884 (1896); L. B. Smith, Contrib. Gray Herb. civ. 81, t. 2 (1934). *T. fusca* Bak. in Journ. Bot. xvi. 240 (1878); xxv. 213 (1887); Brom. 161 (1889); Mez in DC. Mon. Phan. ix. 727 (1896). *T. scalarifolia* Bak. in Journ. Bot. xxv. 235 (1887); Brom. 165 (1889); Mez in DC. Mon. Phan. ix. 857 (1896); Mez ex Bruns in Mitt. Inst. Allg. Bot. Hamburg, viii. 41 (1929); Harms in Engl. & Prantl, Nat. Pflanzenf. ed. 2, xv a. 120 (1930); F. L. Herrera, Est. Fl. Dep. Cuzco, 78 (1930). *T. Schenckiana* Wittm. in Engl. Bot. Jahrb. xi. 63 (1889); Bak. Brom. 165 (1889). *T. chilensis* Bak. Brom. 166 (1889); Mez in DC. Mon. Phan. ix. 857 (1896). *T. lanata* Mez in Bull. Herb. Boiss. ser. 2, v. 109 (1905); Weberbauer, peruan. Anden in Engl. & Drude, Veg. d. Erde, xii. 81 (1911).. *T. favillosa* Mez in Fedde, Rep. Spec. Nov. iii. 43 (1906); Weberbauer, peruan. Anden in Engl. & Drude, Veg. d. Erde, xii. 81 (1911); Harms in Engl. & Prantl, Nat. Pflanzenf. ed. 2, xv a. 120 (1930).

COLOMBIA: CAUCA or TOLIMA (?): near La Plata, alt. 1000 m., 1882, *Lehmann XXVII* (Bo, type of *T. Schenckiana;* BM, phot. G); same, *2234* (Mez!). PERU: SAN MARTIN: near Moyobamba, *Steubel 62 b* (Mez!); LIMA: Obrajillo, *Brackenridge in Wilkes Expedition* (K, type of *T. fusca;* G, US); near Matucana, alt. 2370 m., *Weberbauer 1697* (B, type of *T. lanata;* phot. G); Chosica, alt. 1000 m., 1923, *Macbride 2879* (G, US, FM); CUZCO: prov. Urubamba, near Ollantaitambo, alt. 2800–3000 m., 1905, *Weberbauer 4933* (B, type of *T. favillosa;* phot. G); 1915, *Cook & Gilbert 554* (US); 1925, *F. L. Herrera 702; 801* (US); Torontoy, Urubamba Valley, alt. 2400 m., 1915, *Cook & Gilbert 1774* (US); AREQUIPA: Cachendo, alt. ca. 1000 m., *Guenther & Buchtien 357* (Mez!). BOLIVIA: LA PAZ: La Granja, alt. 2600 m., 1923, *Bro. Julio 158* (US, BM); INDEFINITE: *Pentland* (K, type of *T. scalarifolia;* phot. G). CHILE: without further locality, *Haenke* (Prague, TYPE; phot. G); northern Andes of Chile (Baker!), *Gay* (P, type of *T. chilensis;* phot. G).

In spite of the addition of *T. chilensis* to the synonymy of *T. paleacea* it is still extremely doubtful whether the species occurs in Chile. Gay said of *T. paleacea:* "Dudamos tambien que Haenke haya encontrado esta planta en Chile; á nuestro modo de ver, este país no incluye ninguna especie de Tillandsia con flores en espiga."

In view of this statement and of the fact that the label on the type of *T. chilensis* is merely a form-label with "Chili" printed on it and no further data written in, it seems likely that Gay really collected the plant during his stay at either Lima or Cuzco.

19. **Tillandsia** (§ **Phytarrhiza**) **arhiza** Mez. Roots wholly lacking (Balansa!): stem up to 6 dm. long, stout: leaves densely polystichous, ca. 2 dm. long, ferruginous-cinereous, densely and coarsely pruinose- or tomentose-lepidote; sheaths elongate, broadly elliptic, amplexicaul, ochreiform, glabrous inside and below the middle outside; blades very narrowly triangular, 7–9 mm. wide, channeled, involute-subulate above the middle, filiform-acuminate, erect or diverging, recurving toward apex: scape slender, erect, exceeding the leaves, glabrous; its bracts erect, tubular-involute, equalling or exceeding the internodes, sublanceolate, acute or apiculate, densely lepidote: inflorescence depauperate-compound in the type with two much reduced lateral spikes but more often simple and distichous; axes glabrous; primary bracts like the scape-bracts, lepidote, much shorter than the axillary spikes; single or principal spike linear or lanceolate in outline, up to 75 mm. long, 10 mm. wide, densely 6–12-flowered; rhachis strongly angled, slightly flexuous; floral bracts strictly erect, often closely involute about the sepals, not noticeably imbricate, narrowly elliptic, apiculate, ca. 15 mm. long, from distinctly shorter than to slightly exceeding the sepals even on the same plant, chartaceous, glabrous or the lowest scantly lepidote, prominently nerved: flowers with a very short stout pedicel; sepals elliptic, acute or obtuse, ca. 12 mm. long, 5 mm. wide, even, glabrous, coriaceous, subequally connate up to about 3 mm.; petals violet, ca. 23 mm. long, blades suborbicular, stamens deeply included, exceeding the pistil, anthers linear, acute; ovary elongate, prismatic, abruptly contracted into the style: capsule cylindric, abruptly acute.—Saxicolous; Paraguay.—Mez in DC. Mon. Phan. ix. 855 (1896); Chod. & Vischer, Vég. Par. in Bull. Soc. Bot. Genève, ser. 2, viii. 202–64, t. 98–100, 104 (1916); Hassler in Ann. Cons. & Jard. Bot. Genève, xx. 330 (1919); Harms in Engl. & Prantl, Nat. Pflanzenf. ed. 2, xv a. 120 (1930). *T. rupestris* Mez in DC. Mon. Phan. ix. 856 (1896); Plant. Hassl. ii. 259 in Bull. Herb. Boiss. ser. 2, iii. 1037 (1903); Chod. &

Vischer, Vég. Par. in Bull. Soc. Bot. Genève, ser. 2, viii. 202–64, t. 87–9, 91 (1916). *T. rupestris* var. *pendens* Chod. & Vischer, ibid. 229, t. 91–2 (1916). *T. arhiza* var. *rupestris* Hassler in Ann. Cons. & Jard. Bot. Genève, xx. 331 (1919); Harms in Engl. & Prantl, Nat. Pflanzenf. ed. 2, xv a. 120 (1930).—Pl. III, figs. 2–3.

PARAGUAY: on granite rocks at the summit of Cerro d'Acahy, near Paranaguari, *Balansa 4747* (P, TYPE; phot. G); on granite rocks of Cerro San Thomas near Paranaguari, *Balansa 4746* (Bo, P, type of *T. rupestris;* phot. G); slopes of San Thomas, *Hassler 1000* (K, phot. G).

20. **Tillandsia** (§ **Phytarrhiza**) **caerulea** HBK. Plants up to 25 cm. long, sometimes in dense masses: roots lacking: stem simple, 4–6 cm. long: leaves polystichous, 10–15 cm. long, densely furfuraceous or tomentose-lepidote, cinereous; sheaths ovate, barely over 1 cm. long; blades mostly spreading or reflexed, filiform-subulate, involute, soft, more or less flexuous or contorted, ca. 2 mm. broad at base: scape terminal, erect, up to 15 cm. long, ca. 1 mm. in diameter at base, lepidote; its bracts involute, erect, shorter than the internodes at least as regards the sheathing portion, densely lepidote, filiform-laminate: inflorescence always simple and distichous, 4–7 cm. long, laxly 3–7-flowered with the apical one sterile; rhachis very slender, subterete, lepidote, strongly offset opposite the base of each flower but otherwise only slightly flexuous; floral bracts closely enfolding the calyx, not at all imbricate nor concealing the rhachis, diverging from the rhachis at an angle of about 45°, slightly longer than the internodes, elliptic, acute, ca. 15 mm. long, 7 mm. broad, equalling or exceeding the sepals, chartaceous, prominently nerved, lepidote, sometimes dark purple: flowers sessile; sepals lanceolate, acute, mucronate, prominently nerved, equally short-connate, 12 mm. long, 4 mm. wide, glabrous, thin; petals 20 mm. long, claw narrow, blade subrhombic, 7 mm. wide, blue; stamens ca. 8 mm. long, deeply included, exceeding the pistil, anthers 3 mm. long, linear, dorsifixed near base; ovary stout, subprismatic, about the same length as and but little thicker than the style.—Epiphytic; Ecuador, Peru.—Nov. Gen. i. 291 (1816); R. &. S. Syst. vii. 1209 (1830); Bak. Journ. Bot. xxv. 305 (1887); Brom. 166 (1889); Mez in DC. Mon. Phan. ix. 861 (1896). *T. squamulosa* Willd. ex R. & S. Syst. vii. 1209 (1830), in synon. *Diaphoranthema squamulosa* Beer, Brom. 266 (1857).—Pl. IV, figs. 3–4.

ECUADOR: AZUAY: between Oña and Cuenca, alt. 2700–3300 m., 1923, *Hitchcock 21585* (US); LOJA: between El Tambo and La Toma, alt. 1000–2200 m., 1923, *Hitchcock 21334* (G, US). PERU: PIURA: Rio Macará, *Humboldt & Bonpland 3442* (B, P, TYPE; phot. G); Sancicito, about 40 miles north of

Sallaria, Negritos, *O. Haught F-11* (FM); Amotape Mts., 1926, *O. Haught 128* (US).

What the Mexican citations of Sochipala and Sopilote in the original description of this species stand for I have been unable to ascertain. They can scarcely represent the same species.

The petal-blade of *T. caerulea* is much more like that of typical section *Phytarrhiza* than it is like that of *Diaphoranthema*, and accordingly I have transferred the species to *Phytarrhiza*.

21. **Tillandsia** (§ **Phytarrhiza**) **crocata** (E. Morr.) Bak. Plant 15–35 cm. long: roots present: stem simple or few-branched, up to 2 dm. and more long (Mez!): leaves distichous, 1–3 dm. long, densely tomentose-lepidote with fine reflexed scales; sheaths broadly ovate, glabrous except for the upper half outside; blades spreading or recurving, linear, long-acuminate, involute-subulate, 2–5 mm. in diameter at base: scape terminal, erect or nearly so, slender, 5–15 cm. long, retrorse-tomentose like the leaves, naked or with a single leaf-like bract: inflorescence always simple and distichous, lanceolate or elliptic, acute, 1–4 cm. long not counting the petals or capsules, densely 2–6-flowered with the terminal flower sometimes sterile; floral bracts imbricate, 2–5 times as long as the internodes, ovate, acuminate, up to 2 cm. long, about equalling the sepals, densely tomentose-lepidote: flowers very short-pedicellate, fragrant (Lindman!); sepals sublanceolate, broadly acute or obtuse, thin, prominently nerved, densely appressed-lepidote except in extreme age; petals up to 2 cm. long; blade suborbicular, obtuse, 6–8 mm. broad, bright yellow; stamens deeply included, exceeding the pistil: capsule cylindric, ca. 3 cm. long.—Terrestrial and epiphytic; Bolivia, Brazil, Uruguay, Argentina.—Bak. in Journ. Bot. xxv. 214 (1887); Brom. 163 (1889); Mez in Mart. Fl. Bras. iii. pt. 3, 607 (1894); Mez in DC. Mon. Phan. ix. 860 (1896); Harms in Engl. & Prantl, Nat. Pflanzenf. ed. 2, xv a. 120 (1930); L. B. Smith in Ostenia, 361 (1933). *Phytarrhiza crocata* E. Morr. in Belg. Hort. xxx. 87 (1880). *T. Mandonii* E. Morr. ex Mez in DC. Mon. Phan. ix. 871 (1896); Ann. Cons. & Jard. Bot. Genève, xx. 334 (1919).—Pl. IV, figs. 21–22.

BOLIVIA: LA PAZ: prov. Larecaja, between S. Pedro and Coaconi, alt. 2650 m., 1861, *Mandon 1180* (K, TYPE of *T. Mandonii;* BM, G, S). BRAZIL: PARANÁ: Capão Grande, Villa Velha, alt. 875 m., 1904, *Dusén 4284* (S, MN Rio); Villa Velha, 1910, *Dusén 9238* (S, G, US); RIO GRANDE DO SUL: on little island in the mouth of the Rio Jacuhy, *Tweedie 427* (K, phot. G); Porto Alegre, Morro de Santa Theresa, 1893, *Golland in hb. Lindman* (S); INDEFINITE: 1879, *Lietze* (TYPE; represented by one of the Morren Icones in hb. Kew, not known whether specimen still exists). URUGUAY: MERCEDES: Rincon del Cololo, 1893, *Osten 3055* (Ost); INDEFINITE: *Miers 1367* (BM). ARGENTINA: ENTRE RIOS: Concepcion del Uruguay, 1882, *Hieronymus* (S).

Tillandsia Mandonii was based on very old and weathered material. The only character in its description to distinguish it from *T. crocata* is the supposedly glabrous sepals, but both the Mandon and Miers collections show some scales still left on the sepals.

22. **Tillandsia** (§ **Phytarrhiza**) **bandensis** Bak. Plant 1–2 dm. long: roots present: stem much branched with the branching largely in a single plane, 4–6 cm. long: leaves densely distichous, 5–7 cm. long, densely pruinose- or tomentose-lepidote, cinereous to fuscous; sheaths broadly ovate, ca. 1 cm. long, glabrous except for the upper half outside; blades suberect to spreading, linear-subulate, involute, long-acuminate, 1–2 mm. in diameter at base: scape terminal, erect or decurved, up to 9 cm. long, ca. 0.5 mm. in diameter, sulcate, lepidote at least below; its bracts 1–2, remote, much shorter than the internodes, elliptic, the upper acute or apiculate and usually glabrous, the lower usually filiform-laminate and appressed-lepidote: inflorescence always simple and distichous, linear-lanceolate, 2–3 cm. long and 3–5 mm. wide not counting the petals, 2–4-flowered; rhachis very slender, slightly flexuous, excavated next the flowers, glabrous; floral bracts remote, not at all imbricate, equaling or slightly longer than the internodes, ovate-elliptic, acute, membranaceous, more or less prominently nerved, 9–12 mm. long, the lower ones equaling or somewhat shorter than the sepals and sometimes scantly lepidote, the upper ones much shorter than the sepals and glabrous: flowers strictly erect and appressed to the rhachis; pedicel very short, obconic; sepals subelliptic, acute, 8–10 mm. long, 2.5–3 mm. broad, thin, prominently nerved, glabrous, equally subfree; petals 15–16 mm. long, claw narrow, blade distinct, broadly elliptic or obovate, 5 mm. long, 6 mm. broad, blue or violet; stamens deeply included, exceeding the pistil, anthers linear; ovary subprismatic, passing gradually into the short style: capsule cylindric, ca. 2 cm. long.—Epiphytic; Bolivia, Paraguay, Uruguay, Argentina.—Bak. in Journ. Bot. xxv. 234 (1887); Brom. 165 (1889); Kerr, Bot. Pilcom. in Trans. & Proc. Edinb. Bot. Soc. xx. 73 (1894); Mez in DC. Mon. Phan. ix. 858 (1896); Hassler, Flor. Pilcom. in Trab. Mus. Farmac. B. A. xxi. 42 (1909); Hauman & Vanderveken, Phan. L'Arg. i., in An. Mus. Nac. Hist. Nat. B. A. xxix. 242 (1917); Herter, Florula Urug. 45 (1930); L. B. Smith, Not. Brom. in Ostenia, 362 (1933); Castellanos, Brom. Arg. iv., in An. Mus. Nac. Hist. Nat. B. A. xxxvii. 498 (1933). *T. quadriflora* Bak. Brom. 163 (1889), as to *Miers 1363*. *T. recurvata* var. *majuscula* Mez in Mart. Fl. Bras. iii. pt. 3, 611 (1894). *T. bandensis* var. *intermedia* Hassler in Ann. Cons. & Jard. Bot. Genève, xx. 333 (1919); Castellanos, Brom. & Cact. in Physis, x. 86, t. 2 (1930).

BOLIVIA: Santa Cruz: Cerro de Alto Mairana, alt. 2000 m., 1921, *Steinbach 6039* (FM). PARAGUAY: Gran Chaco, Santa Elisa, 23° 10′ S. lat., 1903, *Hassler 2778* (Bo, type of var. *intermedia;* G, BM). URUGUAY: Salto: 1924, *Schroeder* (Ost 17768 b, G); San José: near San José, *Arechavaleta 2612* (Mez!); Colonia: Carmelo, 1922, *Schroeder* (Ost 16442, G); Indefinite: *Tweedie* (K, type; phot. G); *Miers 1363* (BM). ARGENTINA: Formosa: Rio Pilcomayo, *Kerr 109* (K, phot. G); Formosa, *Jörgensen 2010* (G, US, Mo); *Jörgensen s. n.* (Ost 13780); *Jörgensen 1129* (Castellanos!); Chaco: Resistencia, 1924, *Castellanos 24/1246* (Castellanos!); Jujuy: Quinta, near Laguna de la Brea, 1901, *Fries 417* (S); Rio Chijra, 1924, *Schreiter 2605* (Castellanos!); Salta: Gran Chaco Salteño, Ipaguazo, 1902, *Calcagnini* (Castellanos!); Rio Juramento, 1922, *Castellanos* (Castellanos!); Orán, 1931, *Ragonese* (Castellanos!); Tucumán: dept. Trancas, Vipos, alt. 786 m., 1923, *Schreiter 1265* (Ost, G); Vipos, 1922, *Schreiter 27/2340* (Castellanos!); near Tucumán, 1926, *Schreiter 26/2375*; 1927, *27/2879* (Castellanos!); El Duraznito, near Tucumán, alt. 600 m., 1924, *Venturi 2801* (Ost, S, BA); dept. Trancas, Tapia, alt. 750 m., 1920, *Venturi 1119* (FM, S, Ost, BA); Chañar Pozo, 1919, *Venturi 1127* (Castellanos!); Catamarca: Quebrada de Totoral, Concepción, 1909, *Castillon 6601* (Castellanos!); El Valle, 1886, *Spegazzini 159* (Castellanos!); dept. El Alto, 1928, *Balcosna in hb. Venturi 7184* (Castellanos!); Santiago del Estero: La Parilla, near Gancedo, 1924, *Castellanos 24/1318* (G, BA); Sotelo, 1915, *De Carles 1130* (Castellanos!); La Rioja: General Roca, San Francisco, 1928, *Gomez 28/744* (Castellanos!); Córdoba: dept. San Javier, Yacanto, 1921, *Molfino* (Castellanos!); Santa Fe: Malabrigo, F. C. a Reconquista, 1906, *Schroeder* (Castellanos!); Entre Rios: Concordia, Duraznal, 1931, *Castellanos 31/978* (Castellanos!); Buenos Aires: Delta del Paraná, isla Forges, 1902, *Hicken 101* (Castellanos!); Delta del Paraná, Rio Barca Grande, 1931, *Cabrera 1634* (G, SP); Delta del Paraná, 1916, *Hauman 28/1131* (Castellanos!); San Isidro, 1906, *Hauman 1128* (Castellanos!).

Mez's citations of *T. bandensis* are so badly mixed geographically that it is not possible to use them without further checking, although I have little doubt of their taxonomic accuracy. The main trouble is his interpretation of the old term, "*Banda Oriental,*" as Paraguay, when it should be Uruguay. In addition I can find no basis for his considering that the Tweedie material came from Brazil.

As already pointed out in Ostenia, Hassler's var. *intermedia* differs from Mez's description of the type of *T. bandensis* but not from the type.

23. **Tillandsia** (§ **Phytarrhiza**) **Mallemontii** Glaziou. Plant up to 25 cm. long: roots present: stem very slender, 1–2 dm. long, branching: leaves distichous, up to 12 cm. long, cinereous, densely pruinose-lepidote; sheaths narrowly ovate, up to 2 cm. long, membranaceous, glabrous within and below on the outside; blades mostly spreading or reflexed, irregularly curved, linear, long-acuminate, 1–1.5 mm. in diameter: scape terminal, erect to strongly curved, up to 13 cm. long, lepidote, almost filiform; scape-bracts like the floral bracts but sometimes long-laminate, 1 or 2 immediately below the inflorescence or rarely one somewhat remote: inflorescence always simple and distichous, narrowly lanceolate, complanate, 25 mm. long

and 4 mm. wide not counting the petals, densely 1–4-flowered; rhachis glabrous, compressed, slightly geniculate; floral bracts slightly more than twice as long as the internodes but not really imbricate because separated by the flowers at anthesis, ovate, acute, up to 9 mm. long, ecarinate, prominently nerved, thin, densely lepidote: flowers strictly erect, subsessile; sepals suboblong, acute, 12.5 mm. long, glabrous, nerved, equally short-connate; petals up to 17 mm. long, claw linear, blade suborbicular, obtuse, 6.5 mm. broad, spreading at anthesis, blue or violet; stamens deeply included, exceeding the pistil, anthers oblong, obtuse, 2 mm. long; ovary cylindric, abruptly contracted into the short thick style.—Terrestrial and epiphytic; Brazil.—Glaziou ex Mez in Mart. Fl. Bras. iii. pt. 3, 608, t. 114, fig. 1 (1894); Mez in DC. Mon. Phan. ix. 859 (1896); Silveira, Narrativas e Memorias, i. 277 (1924); Flor. Montium, ii. 6, t. 8 (1931). *T. linearis* Vell. sensu Bak. Journ. Bot. xxv. 234 (1887); Brom. 164 (1889), non Vell. (1825). *Phytarhiza uniflora* E. Morr. ex Bak. Brom. 164 (1889), in synon.

BRAZIL: Rio de Janeiro: Alt. Macahé, near Nova Friburgo, 1891, *Glaziou 18563* (US, K, phot. G); Federal District: near Tijucá, *Glaziou 14345* (B, type; K); horto imperiali, São Christovão, Rio de Janeiro, 1892, *Lindman A 35* (S); same, 1897, *Ule 1313 in part* (MN Rio); São Paulo: *St.-Hilaire Cat. C², 1451* (P); Paraná: *Binot* (Mez!); Villa Velha, 1904, *Dusén 4107* (MN Rio); Jaguariahyva, alt. 740 m., 1910, *Dusén 10071* (S); Porto Amazonas, alt. 700 m., *Lange in hb. Dusén 9530* (S); Santa Catharina: near Tubarão, *Ule 1313 in part* (Mez!); Rio Grande do Sul: Cachoeira, on the road to Colonia S. Angelo, 1893, *Lindman A 1007* (S); Pelotas, 1923, *Parcus* (Ost 17082).

When the petals of *T. Mallemontii* are well expanded there is no danger of mistaking it for *T. recurvata*, but except for the petals there is no one character that holds. Within the range of *T. Mallemontii*, *T. recurvata* is usually much smaller. *T. Mallemontii* combines the characters of large size, long stem and all floral bracts shorter than the sepals. *T. recurvata* has the same characters but not all combined at once.

Mez gives *Phytarhiza uniflora* as a synonym of *Tillandsia recurvata*, presumably on the ground that *Tillandsia uniflora* was. However, there is no evidence that Morren intended *Phytarhiza uniflora* as a new combination and his plate in the Kew herbarium is unmistakably *T. Mallemontii*.

24. **Tillandsia** (§ **Diaphoranthema**) **loliacea** Mart. Plants up to 17 cm. long but usually much less: roots present: stem usually evident, simple or branched, rarely more than 4 cm. long: leaves densely polystichous, up to 4 cm. (Mez!) but usually 2–3 cm. long,

cinereous to fuscous, densely and coarsely pruinose-lepidote; sheaths ca. 3 mm. long, but slightly broader than the blade, glabrous, pale, subcoriaceous with broad hyaline margins, prominently nerved; blades erect to suberect or arching-secund, rigid, very narrowly triangular, long-acuminate but not filiform, 3–5 mm. wide at base: scape terminal, straight or curving, up to 10 cm. long, less than 1 mm. in diameter, lepidote; its bracts numerous, about equaling the internodes, elliptic, acute, chartaceous, prominently nerved, densely lepidote: inflorescence always simple and distichous, linear, up to 4 cm. long, very much like that of *Lolium* in its size and sinuous outline, up to 16-flowered (Hoehne!) but often with very few; rhachis strongly geniculate, flattened and excavated next the flowers, lepidote; floral bracts not at all imbricate, about one and a half times as long as the internodes, closely enfolding the flowers, ovate, acute, 8 mm. long, equaling or shorter than the sepals, thin, strongly nerved, densely lepidote: flowers erect and appressed to the rhachis, subsessile; sepals lanceolate, acute, up to 9 mm. long, glabrous, prominently nerved, equally short-connate; petals 10 mm. long, pale violet (Mez!) to yellow, claw sublinear, blade narrow, acute; stamens deeply included, exceeding the pistil, anthers 1.25 mm. long; ovary short-cylindric, abruptly contracted into the thick style; ovules long-caudate: capsule slenderly cylindric, short-beaked, up to 45 mm. long (Mez!).—Terrestrial and epiphytic; Brazil, Peru, Bolivia, Paraguay, Uruguay, Argentina.—Mart. ex R. & S. Syst. vii. 1204 (1830); Bak. Journ. Bot. xxv. 344 (1887); Brom. 189 (1889); Mez in Mart. Fl. Bras. iii. pt. 3, 611, t. 114, fig. 2 (1894); Mez in DC. Mon. Phan. ix. 862 (1896); O. Ktze. Rev. Gen. iii. 304 (1898); Mez, Plant. Hassl. ii. 259 in Bull. Herb. Boiss. ser. 2, iii. 1037 (1903); Chod. & Vischer, Vég. Par. in Bull. Soc. Bot. Genève, ser. 2, viii. 202–64, t. 76, 81–5 (1916); Hassler in Ann. Cons. & Jard. Bot. Genève, xx. 333 (1919); Hoehne in Comm. Linh. Telegr. Estrat. Matto-Grosso (Publ. 47), Annexo, v. Bot. pt. 9, 14, t. 164 (1919); Castellanos, Brom. Arg. iv., in An. Mus. Nac. Hist. Nat. B. A. xxxvii. 504 (1933). *T. undulata* Bak. in Journ. Bot. xvi. 240 (1878); xxv. 213 (1887); Brom. 162 (1889). *T. quadriflora* Bak. Brom. 163 (1889), in part. *T. atrichoides* S. Moore in Trans. Linn. Soc. ser. 2, iv. 491 (1895).

BRAZIL: CEARÁ: Cariri, 1910, *Löfgren 496* (S, MN Rio); BAHIA: Monte Santo, near Joazeiro, *Martius* (Mun, TYPE; phot. G); MINAS GERAES: *Glaziou 13241* (P); Conselheiro Matta-Rodeador, 1934, *Brade 13498* (JB Rio, G); SÃO PAULO: Descalvado, 1932, *A. Gehrt in hb. S. P. 29795* (G, SP); MATTO GROSSO: between Corumbá and Ladário, 1892, *S. Moore 1046* (BM, type of *T. atrichoides*; phot. G); Diamantino, 1894, *Lindman b* (S); Corumbá, 1902, *Robert in hb. Sladen 791* (BM); 1911, *Hoehne 3556-9* (MN Rio). PERU:

Mathews (Mez!). BOLIVIA: Santa Cruz: Velasco, alt. 200 m., 1892, *Kuntze* (NY); Oriente, Charagua, alt. 800 m., 1934, *Cardenas 2681* (G); Indefinite: *Mandon 1176; Weddell 4175* (Mez!). PARAGUAY: mouth of the Rio Spane, near Villa Concepcion, 1875, *Balansa 619* (K, type of *T. undulata;* phot. G); Asuncion, 1874, *Balansa 619 a* (S); northern Paraguay, 1892, *Kuntze* (NY); El Chaco, Banks of the Rio Pilcomayo, 1893, *Lindman a* (S); Asuncion, Itapitapunta, 1893, *Lindman A 1611 a* (S); Paraguarí, 1893, *Lindman A 1611 b* (S); Cordillera de Altos, *Hassler 3861* (Mez!); Cerro Hu, Paraguary, *Hassler 2609* (Mez!); near Concepcion, *Hassler 7434* (Mez!); central Paraguay, *Rojas 1309* (Hassler!); *Chodat & Vischer 102, 102 bis* (Hassler!); San Bernardino, Ypecarai, 1915, *Osten 8106* (G, Ost, S); 1916, *Osten 8920, 8922 b* (Ost). ARGENTINA: Misiones: *Niederlein* (Mez!); Formosa: Guayculé, *Jörgensen 3396* (G, US, Mo, BA); Formosa, 1917, *Muello* (Castellanos!); Chaco: near Resistencia, *Niederlein* (Mez!); Jujuy: Quinta, near Laguna de la Brea, 1901, *Fries 207, 415* (S); Santa Clara, 1901, *Fries 497* (S); Moralitos, 1922, *Castellanos* (Castellanos!); Salta: Gran Chaco Salteño, Ipaguazo, 1902, *Calcagnini* (Castellanos!); Tabacal, 1928, *Burkart 28/707* (Castellanos!); between Embarcación and Yacuiba, 1923, *Hauman 1568* (Castellanos!); Corrientes: near Riachuelo, *Niederlein* (Mez!); Indefinite: *Hieronymus* (Mez!).

25. **Tillandsia** (§ **Diaphoranthema**) **erecta** Gill. Plant up to 11 cm. long: roots present: stem 3–6 cm. long, simple or few-branched: leaves densely polystichous, up to 5 cm. long, cinereous, densely and coarsely pruinose-lepidote; sheaths broadly ovate, ca. 5 mm. long, glabrous within and at the extreme base outside; blades erect to spreading, very narrowly triangular, involute-subulate, rigid, prominently nerved, angled toward apex, ca. 4 mm. broad at base: scape terminal, up to 45 mm. long, slender, strongly sulcate, glabrous, naked or with a single elliptic glabrous bract ca. 15 mm. long: inflorescence of a single flower with the rhachis prolonged behind it; floral bract triangular-ovate, acute, 8–10 mm. long, equaling or shorter than the sepals, glabrous, prominently 7–10-nerved: flower subsessile; sepals elliptic-lanceolate, acute, 10 mm. long, glabrous or scantly lepidote, prominently nerved, equally short-connate; petals narrowly elliptic, yellow in the dried material, punctate; stamens deeply included, exceeding the pistil: capsule slenderly cylindric, ca. 2 cm. long, abruptly short-beaked.—Epiphytic; Argentina.—Gill. ex Bak. in Journ. Bot. xvi. 239 (1878); xxv. 213 (1887); Brom. 162 (1889); Mez in DC. Mon. Phan. ix. 866 (1896); Hauman & Vanderveken, Phan. L'Arg. i., in An. Mus. Nac. Hist. Nat. B. A. xxix. 244 (1917). *T. rigida* Gill. ex Bak. in Journ. Bot. xvi. 239 (1878), in synonymy; Mez in DC. Mon. Phan. ix. 884 (1896). "Var. *T. rigida*" Gill. ex Bak. Brom. 162 (1889).—Pl. IV, fig. 2.

ARGENTINA: Mendoza: foot of the cordillera, near Mendoza, without date, *Gillies* (K, type; phot. G); same, 1822, *Gillies* (K, type of *T. rigida;* phot. G); Indefinite: *Castellanos* (G, BA).

26. **Tillandsia** (§ **Diaphoranthema**) **funebris** Castellanos.

Plant small, rarely over 10 cm. long including the inflorescence: stems several from a single point, densely massed, simple or few-branched, 2–5 cm. long: roots present: leaves densely distichous or polystichous, up to 5 cm. long; sheaths distinct, suborbicular to reniform, densely imbricate, making the stem appear stout, 5–8 mm. long, glabrous below, subcoriaceous, many-nerved with broad nerveless membranaceous margins; blades divergent to reflexed, more or less contorted, triangular-subulate, 2–3 mm. thick, strongly angled but not at all sulcate-striate, often distinctly keeled below, convolute above, acuminate, densely cinereous-lepidote with small nearly symmetrical subappressed to reflexed-pruinose scales: scape distinct, always terminal apparently, slender, erect, up to 5 cm. long, glabrous, strongly angled, naked for most of its length; scape-bracts oblong-lanceolate, acute, up to 17 mm. long but usually about 13 mm., subcoriaceous, many-nerved, even, 2 in number, usually a somewhat lepidote one near the base of the scape and a glabrous one just below the inflorescence: inflorescence 1–2-flowered, glabrous; floral bracts like the upper scape-bract but more ovate and progressively smaller, from slightly shorter to slightly longer than the sepals, even; rhachis like the scape and nearly as thick, swollen at the nodes: flowers subsessile, erect; sepals lanceolate, acute, even, many-nerved, 10 mm. long, equally connate for about 2 mm.; petals 13 mm. long, dark orange-brown when dry, coffee-colored when fresh (Venturi!), blade distinct, subrhombic, obtuse, spreading and often circinnate at anthesis; stamens deeply included, anthers basifixed, linear, acutish, less than 2 mm. long, filaments slightly shorter than the pistil; ovary ellipsoid, obtusely angled, contracted into the short thick style, stigma broadly capitate: capsule slenderly cylindric, 2 cm. long: seeds few.—Epiphytic; southeastern Bolivia and northwestern Argentina.—Castellanos, Brom. Arg. iv., in An. Mus. Nac. Hist. Nat. B. A. xxxvii. 502 (1933).

BOLIVIA: SANTA CRUZ: Oriente, Charagua to Izozog, alt. 800 m., 1934, *Cardenas 2688* (G). ARGENTINA: SALTA: La Candelaria, Unquillo, 1931, *Schreiter 6619* (Castellanos!); TUCUMAN: dept. Trancas, Vipos, alt. 786–850 m., 1922, *Venturi 1873* (G, US, S); *Schreiter 1689* (BA 27/2362, TYPE; G); 1923, *Schreiter 160 r* (Osten 17377).

This species is probably a close relative of *T. aizoides*, having the same trait of an isolated scape-bract just below the inflorescence, but its larger and spreading leaves distinguish it at first glance. In habit, *T. funebris* closely resembles *T. erecta*.

Castellanos records larger measurements for parts of the inflorescence than I have been able to find.

T. funebris is one of the species which appear transitional between *Phytarrhiza* and *Diaphoranthema.*

27. **Tillandsia** (§ **Diaphoranthema**) **tricholepis** Bak. Plant moss-like: roots present: stems many from a single point, densely massed, at first bearing flowers when short and simple but later elongate and much branched, up to 22 cm. long including the longest branch, but usually much less: leaves densely polystichous, up to 15 mm. long but averaging about 10 mm.; sheaths distinct, broadly ovate, glabrous and covered by the one below except at the extreme apex, membranaceous, scarious with 4 to 5 central nerves and broad nerveless margins; blades appressed to somewhat divergent, narrowly triangular, subulate-acuminate, involute, densely ferruginous- or cinereous-furfuraceous with lacerate asymmetric scales produced below into a spreading lobe so that under a lens the leaves appear reflexed-tomentose: scapes at first terminal, soon becoming pseudo-axillary by the elongation of the stem, slender, straight or somewhat flexuous, 1–4 cm. long, 0.3–0.5 mm. thick, sulcate, soon glabrous; scape-bracts several, evenly distributed, nearly or quite as long as the internodes, closely enfolding and concealing most of the scape, lanceolate, acute, membranaceous, sulcate, lepidote, 5–8 mm. long: inflorescence always of a single spike, 1–5-flowered, sometimes with a sterile floret at apex, narrowly lanceolate, up to 17 mm. long; rhachis slender, nearly straight, strongly angled, glabrous; floral bracts like the scape-bracts but broadly ovate, enfolding the rhachis for about half their length, slightly but consistently shorter than the sepals: flowers erect, subsessile but appearing stipitate because of the narrowing of the calyx-tube, up to 9 mm. long; sepals lanceolate, acute, equally connate at base for 1.5 mm., 6.5 mm. long, glabrous or with a very few scales, membranaceous, strongly nerved; petals pale yellow, punctate, linear, blade indistinct, obtuse, spreading at anthesis; stamens deeply included, less than half as long as the petals, exceeding the style, anthers linear, acutish, basifixed; ovary prismatic with a projecting ring just below the apex, style short but slender, stigmas just reaching the base of the anthers: capsule narrowly cylindric, abruptly contracted into a short beak, up to 2 cm. long, valves separating nearly to the base, remaining straight; seed narrowly fusiform, brown, up to 3 mm. long, with a short white beak at apex and at base a white coma up to 14 mm. long.—Epiphytic; eastern Brazil, Bolivia, Paraguay, and northern Argentina.—Bak. in Journ. Bot. xvi. 237 (1878); xxv. 213 (1887); Brom. 160 (1889); O. Ktze. Rev. Gen. iii. 304 (1898); Hassler in Ann. Cons. & Jard. Bot. Genève, xx. 334 (1919);

Castellanos, Brom. Arg. iv., in An. Mus. Nac. Hist. Nat. B. A. xxxvii. 507 (1933). *T. tricholepis* var. *argentea* Hassler in Ann. Cons. & Jard. Bot. Genève, xx. 334 (1919). *T. bryoides* Griseb. (in part) Symb. Arg. in Goett. Abh. xxiv. 334 (1879); Bak. Brom. 160 (1889); Morong & Britton, Enum. Pl. Parag. in Contrib. Herb. Columbia Coll. xxxv. in Ann. N. Y. Acad. Sci. vii. 236 (1892). *T. polytrichoides* E. Morr. in Belg. Hort. xxx. 240 (1880); Mez in Mart. Fl. Bras. iii. pt. 3, 612, t. 114, fig. 3 (1894); Mez in DC. Mon. Phan. ix. 863 (1896); Mez, Pl. Hassl. ii. 259, in Bull. Herb. Boiss. ser. 2, iii. 1037 (1903); Hassler, Fl. Pilcom. in Trab. Mus. Farmac. B. A. xxi. 41 (1909); Chod. & Vischer, Vég. Par. in Bull. Soc. Bot. Genève, ser. 2, viii. 210, 221, 232, 234, 260, t. 93–5 (1916); Hauman & Vanderveken, Phan. L'Arg. i., in An. Mus. Nac. Hist. Nat. B. A. xxix. 246 (1917); Herzog in Engl. & Drude, Veg. d. Erde, xv. 96–7 (1923); Lillo in Bol. Univ. Nac. Tucumán, i. no. 6, 5 (1925); Silveira, Narrativas e Memorias, i. 282 (1924); Flor. Montium, ii. 4, 5, 12, 13, t. 3 (1931); Harms in Engl. & Prantl, Nat. Pflanzenf. ed. 2, xv a. 122 (1930).

BRAZIL: Ceará: *F. Allemão CLXXI* (MN Rio); *Allemão & Cysneiros 1525; 1526 in part* (MN Rio); Minas Geraes: Conselheiro Matta-Rodeador, 1934, *Brade 13497* (JB Rio, G); Rio de Janeiro: on ironwork over Rio Parahyba, Barra do Pirahy, *Silveira* (Silveira!); Federal District: São Christovão, Rio de Janeiro, *Glaziou 3124; Schwacke 5458* (Mez!); 1892, *Lindman A 37* (S); 1929, *Brade 2168* (G); Indefinite: *Glaziou 66* (type of *T. polytrichoides*). BOLIVIA: El Beni: Trinidad, alt. 250 m., 1926, *Werdermann 2396* (S); La Paz: Poquerani, San Pedro, near Sorata, alt. 2500–2650 m., 1859, *Mandon 1179 in part* (K, type; BM, S, G, NY); Apolo, 1902, *R. S. Williams 1486* (NY, US, BM); prov. Inquisivi, Cañamina, alt. 1700 m., 1921, *O. E. White 272* (NY); Santa Cruz: Santa Cruz de la Sierra, alt. 1600 m., 1892, *O. Kuntze* (NY); "monte," Camatindi near Cumbarute and Woyuywe, Rio Parapiti, ca. 20° 25′ S. lat., 1910, *Herzog 1195* (S); Chaco, Agua Caliente near Charagua, alt. 800 m., 1934, *Cardenas 2611* (G, FM); Indefinite: 1861–3, *Pearce* (BM); *Weddell 3655* (P). PARAGUAY: Asuncion, 1874, *Balansa 617* (S, G, US); central Paraguay, between Villa Rica and Escoba, 1888–90, *Morong 492* (NY, G, US, Mo, BM); central Paraguay, *Balansa 617 a; Hassler 2610; Chodat & Vischer 93; 103* (Hassler!); upper Rio Apa, *Hassler 8517* (Hassler!, type of var. *argentea*); Pilcomayo River, Gran Chaco, *Morong 1086* (NY, BM); *Rojas 686* (Hassler!, as var. *argentea*); Cerros de Acahy, 1919, *Hassler 152* (Ost); northern Paraguay, 1892, *O. Kuntze* (NY); Asuncion, Itapitapunta, 1893, *Lindman 1611* (S); Colonia Elisa near San Antonio, 1893, *Lindman A 1781* (S, G); El Chaco, Paso Manduvi, Rio Pilcomayo, 1893, *Lindman A 1897 1/2* (S, G); El Chaco, Obraje Gill, Rio Pilcomayo, 1893, *Lindman A 1905 1/2* (S, G); Cerro de Acahy, 1919, *Rojas 152* (Ost); Ypacarai, San Bernardino, 1915, *Osten 8105* (Ost); indefinite, *Weddell 3222* (P). ARGENTINA: Formosa: Formosa, 1917, *Jörgensen* (S); 1919, *2800* (G, Mo); near Laishi, 1918, with *Jörgensen 2576* (Ost); Jujuy: Quinta near Laguna de la Brea, 1901, *Fries 416* (S); dept. Ledesma, Sierra de Calilagua, alt. 700 m., 1927, *Venturi 7291* (US); San Pedro, 1893, *Spegazzini 163* (Castellanos!); Salta: Salta, 1901, *Fries 14* (S); dept. Orán, Obra Grande, alt. 750 m., 1927, *Venturi 5620* (US); Orán, 1931, *Ragonese* (Castellanos!); Termas de Rosario de la Frontera, 1931, *Herborn* (Castellanos!); Orán, Pichanal, 1913, *Rodriguez 1119* (G, BA);

dept. Candelaria, Sierra de la Candelaria, alt. 1100 m., 1924, *Venturi 4080* (US); Tartagal, 1924, *Schreiter 3508* (Castellanos!); 1930, *Parodi 9232* (G); TUCUMAN: La Cruz, 1872, *Lorentz & Hieronymus 60* (NY); Tafi viejo, *Tatter in hb. Kurtz 4146* (Mez!); Lules, 1916, *Sanzin 1160* (Ost); Alpachiri, 1916, *Jörgensen* (Ost 11666); dept. Trancas, Vipos, alt. 850 m., 1922, *Venturi 1977* (G, US); dept. Capital, El Duraznito, alt. 600 m., 1924, *Venturi 2799* (G); indefinite, 1918, *Schreiter 800* (Ost, S); SAN JUAN: San Juan, 1931, *Correa* (Castellanos!); CÓRDOBA: 1877, *Hieronymus* (BM); Estancia Germania, near Córdoba, 1874, *Lorentz 128 in part* (BM, Mun); near Córdoba, 1876, *Hieronymus 482* (FM); Chacra de La Merced, 1881, *Hieronymus* (NY); SANTA FE: Colonia Margarita, 1905, *Wolfhügel* (Castellanos!).

The name of *T. tricholepis* for this species has clear priority over the others. Mez chose the later *T. polytrichoides*, so far as can be inferred without any explanatory note, because the type of *T. tricholepis* came from a mixed number. Yet Baker clearly distinguished *T. tricholepis* from *T. bryoides*, the other species under *Mandon 1179*, when he said: "Peduncle . . . 1–2-flowered, . . . with several . . . bracts." These few words eliminate *T. bryoides* completely, since it never has more than one flower and its peduncle or scape if present is always naked. Mez's distinction in the key to his monograph is really less complete when it divides between inflorescence 1-flowered and more than 1-flowered, because in *T. tricholepis* the inflorescence on the same plant may be both 1-flowered and up to 5-flowered as in *Morong 492* (G). The real point between the two is the presence or absence of scape-bracts.

Hassler's variety *argentea* does not appear tenable to me, since the color of the leaf-scales varies considerably on a single plant and appears to be largely a matter of age and treatment in collecting.

28. **Tillandsia** (§ **Diaphoranthema**) **bryoides** Griseb. emend. L. B. Smith. Plant small and with a habit like that of *Lycopodium Selago:* roots present: stems many from a single point, densely massed, simple or sparingly branched, rarely more than 5 cm. long including the longest branch: leaves densely polystichous, 4–9 mm. long but averaging about 6 mm.; sheaths distinct, broadly ovate or triangular to suborbicular, usually as long as the blade, glabrous below, membranaceous, scarious, with 3 central nerves which often touch and broad nerveless margins; blades erect, strict, making the stem appear terete, subtriangular, acute, concave above, convex below, becoming obtusely carinate toward base, up to 2 mm. broad, densely cinereous-lepidote, the scales varying from suborbicular to strongly asymmetric with an elliptic or triangular basal lobe, denticulate, spreading at base so that under a lens the leaves appear reflexed-tomentose: scape often lacking so that the inflorescence is sunk among the terminal leaves, when present evidently elongating only after anthesis, erect,

slender, glabrous, sulcate, naked or with a single lanceolate bract enfolding its extreme base, up to 3 cm. long: inflorescence usually terminal but sometimes becoming pseudoaxillary by the elongation of the stem, always composed of a single flower; floral bract up to 7 mm. long, triangular-ovate, hyaline with a single median excurrent nerve, glabrous or with a few scales toward apex: flower subsessile; sepals linear-elliptic, 5–9 mm. long, obtuse or acute, hyaline, 3-nerved, slightly exceeding the floral bract, equally short-connate for about 1 mm. at base; petals linear with little distinction between claw and blade, erect or nearly so at anthesis, not twisted, fleshy, orange-brown when dry, sulphur-yellow when fresh (Schreiter! Castellanos!); stamens deeply included, anthers linear, filaments about equaling the pistil; ovary subprismatic, stout, abruptly contracted into the short but slender style, stigma capitate: capsule slenderly cylindric, abruptly contracted into a short beak, up to 17 mm. long; seeds few.—Epiphytic and saxicolous; Peru, Bolivia, Argentina.—Griseb. ex Bak. in Journ. Bot. xvi. 236 (1878); xxv. 213 (1887); Griseb. Symb. Argent. in Goett. Abh. xxiv. 334 (1879); Lor. & Niederl. in Roca, Exped. Rio Negro, ii. 283 (1881); Wittm. in Engl. & Prantl, Nat. Pflanzenf. ii. Abt. 4, 56 (1888); Bak. Brom. 160 (1889); O. Ktze. Rev. Gen. iii. 303 (1898). *T. coarctata* Gillies ex Bak. in Journ. Bot. xvi. 236 (1878) in synonymy, not Willd. (1830); Ball (authority wrongly given as "W"), in Journ. Linn. Soc. xxi. 234 (1884); Mez in DC. Mon. Phan. ix. 865 (1896); Macloskie, Rep. Princeton Univ. Exped. Patagonia, viii. 293 (1904); Hicken, Notas Bot. 13 (1908); Hauman in An. Mus. Nac. Hist. Nat. B. A. xxiv. 376 (1913); Hauman & Vanderveken, Phan. L'Arg. i., in An. Mus. Nac. Hist. Nat. B. A. xxix. 243 (1917); Herzog in Engl. & Drude, Veg. d. Erde, xv. 97 (1923); Harms in Engl. & Prantl, Nat. Pflanzenf. ed. 2, xv a. 122 (1930); Castellanos, Brom. Arg. iv., in An. Mus. Nac. Hist. Nat. B. A. xxxvii. 499 (1933). *T. coarctata* var. *pedicellata* Mez in DC. Mon. Phan. ix. 865 (1896); Macloskie, Rep. Princeton Univ. Exped. Patagonia, viii. 294 (1904); Castellanos, Brom. Arg. iv., in An. Mus. Nac. Hist. Nat. B. A. xxxvii. 499 (1933).—Pl. IV, figs. 5–7.

PERU: *Gay 1574* (P). BOLIVIA: LA PAZ: prov. Larecaja, near Sorata, alt. 2500–2650 m., 1858–9, *Mandon 1179 in part* (K, BM); indefinite, alt, over 4000 m., *Pentland 29* (P); Huancana, alt. 2800 m., 1906, *Buchtien 806* (US, NY); Cotaña, near Illimani, alt. 2450 m., 1911, *Buchtien 4144* (G); POTOSI: Rio Blanco, 1932, *Cardenas 318* (US); COCHABAMBA: Parotani, alt. 2400 m., 1892, *Kuntze* (NY); SANTA CRUZ: "monte," Cumbarute and Woyuywe, Rio Parapiti, ca. 20° 25′ S. lat., 1910, *Herzog* (Herzog!); Oriente, Charagua to Izozog, alt. 800 m., 1934, *Cardenas 2690* (G); CHUQUISACA: Camataqui, alt. 1800 m., 1932, *Cardenas 213* (G); INDEFINITE: *Miers 7592–7592x* (BM).

ARGENTINA: JUJUY: termas de Reyes, 1928, *Burkart 27/708* (Castellanos!); Volcán, 1927, *Castillon 6571* (Castellanos!); 1922, *Castellanos* (Castellanos!); SALTA: Metán, 1930, *Castellanos 30/3026* (Castellanos!); Cafayate, 1919, *Hauman 1133* (Castellanos!); indefinite, *Weber* (Mez!); TUCUMÁN: dept. Trancas, Vipos, 1921, *Schreiter 27/2360* (G, BA); same, alt. 786 m., 1922, *Schreiter 2029* (Ost); same, alt. 850 m., 1922, *Venturi 1978* (G, US, Ost, BA); CATAMARCA: 1899, *Spegazzini 199* (Castellanos!); 1904, *Baldi* (Castellanos!); SANTIAGO DEL ESTERO: near Santiago, 1906, *Spegazzini 198* (Castellanos!); LA RIOJA: Sierra de Famatina, Guanchín, 1928, *Castellanos 28/106* (Castellanos!); CÓRDOBA: Sierra Achala, *Hieronymus 795 in part* (BM); Sierra Chica, "El Zapato," near Capilla del Monte, alt. ca. 1000 m., 1917, *Osten 10543* (Ost); 1918, *Osten 13469* (Ost, S); *13470* (Ost); Sierra Chica, Rio Pintos, alt. ca. 1000 m., 1918, *Osten 13495* (Ost, S); between Rio Pintos and Characate, *Osten 13494* (Ost); Sierra Chica, Los Paredones, near Capilla del Monte, alt. ca. 1000 m., 1918, *Osten 13468* (Ost); Valle de los Reartes, 1920, *Castellanos* (Ost 15281); 1925, *Castellanos 25/1748* (G, BA); Sierra Grande, 1920, *Castellanos* (Ost 15282); dept. San Javier, Yacanto, 1920, *Hauman 1135* (Castellanos!); Achala cuesta del Mogote, 1922, *Castellanos 1589* (Castellanos!); indefinite, *Lossen 189* (G, Mo); *Miers 1084* (BM); *Lorentz 128 in part* (TYPE); 1876, *Hieronymus 133* (US); SAN LUIS: Quebrada del Salado, 1882, *Galander* (US); Quines, quebrada del Zapallar, 1925, *Castellanos 25/619* (Castellanos!); Concarán, 1925, *Castellanos 25/2626* (Castellanos!); Cerro Varela, 1925, *Castellanos 25/2777* (Castellanos!); Santa Rosa del Gigante, 1926, *Castellanos 26/2047* (Castellanos!); Los Gigantes, 1926, *Castellanos 26/2044* (Castellanos!); San Francisco, quebrada de Ramos, 1925, *Castellanos 25/617* (Castellanos!); MENDOZA: foot of the Cordillera near Mendoza, 1825, *Gillies* (Cam, K, type of *T. coarctata;* phot. G); Potrerillos, alt. 1400 m., 1907, *Osten 5107* (Ost); Precord. San Ignacio, alt. 1300 m., 1915, *Sanzin 566* (Ost); Cacheuta, 1916, *Ruiz 116* (G, BA); San Rafael, Cañada Seca, 1921, *Ruiz 901* (G, BA); BUENOS AIRES: Rio Negro Inferior, 1912, *Hauman 1134* (Castellanos!); Sierra Ventana, 1881, *Lorentz 751* (Ost); *Lorentz* (US); *Hicken* (Castellanos!); LA PAMPA: Sierra Lihuel Calel, 1927, *Castellanos 27/266* (Castellanos!); CHUBUT: Camarones, 1912, *Aurelius 23* (S, phot. G); INDEFINITE: northern Argentina, *Hieronymus 351; 883; Hieronymus & Niederlein 852; Lorentz 351; Niederlein 26 in part* (Mez!); valley of the Rio Colorado, near Fuerte Pinzen, 1879, *Lorentz & Niederlein* (L. & N.! Mez!); valley of the Rio Negro, *Claraz 207* (Ball!); Sierras Pampeanas, 1881, *Lorentz 47* (NY).

Tillandsia bryoides was described from a mixed sheet and the original description unfortunately contained both elements. One element had already been described as *T. tricholepis,* so that the description is amended here to fit the previously undescribed second element. The only definite correction is that the spikes never have more than a single flower instead of: "Flowers 1–3." The name *T. coarctata* is invalid for this species by both the priority and homonym rules.

Osten 5107 has both flowers and fruit, and the flowers are all sessile while the fruits are all elevated on a definite scape. This evidence would indicate that the scape elongates only after anthesis. If individuals were consistent in this process Mez's *T. coarctata* var. *pedicellata* would be a valid distinction, but capsules both with and without a scape may be found on the same plant as in *Aurelius 23.*

Aurelius 23 is further noteworthy in that it establishes a new southern limit (ca. 45° S. lat.) for the entire *Bromeliaceae*.

29. **Tillandsia** (§ **Diaphoranthema**) **aizoides** Mez. Plant small and with a habit closely resembling that of *T. bryoides* but coarser and less compact: roots present: stems many from a single point, densely massed, simple or sparingly branched, up to 4 cm. long: leaves densely polystichous, usually about 10 mm. long, rarely up to 20 mm. (Mez!); sheaths distinct, broadly ovate, scarious, with 4–many nerves and broad nerveless margins; blades erect but somewhat divergent and not strict as in *T. bryoides,* sometimes slightly secund, angular-subulate, mucronate-acute, stout, 2 mm. thick, convex below, channeled above, densely cinereous-lepidote with reflexed-spreading scales: scape usually terminal, from very short to 2 cm. long, glabrous, angled, naked except for 1 or 2 bracts immediately below the flower or with a single bract midway; scape-bracts elliptic, acute, glabrous, often carinate (Mez!), sulcate with several strong nerves: inflorescence always composed of a single flower; floral bract elliptic, obtuse or apiculate, membranaceous, at least 3-nerved, shorter than the sepals: sepals elliptic, obtuse or acute, ca. 8 mm. long, glabrous, scarious, 5–7-nerved, connate anteriorly for 2 mm., posteriorly for 2.5 mm.; petals linear with little distinction between claw and blade, brownish when dry, probably yellow when fresh, but slightly exceeding the sepals; stamens deeply included, anthers linear; pistil not known: capsule slenderly cylindric, up to 2 cm. long, abruptly contracted into a short beak; seeds few.—Epiphytic and saxicolous; northwestern Argentina.—Mez in DC. Mon. Phan. ix. 866 (1896); Hauman & Vanderveken, Phan. L'Arg. i., in An. Mus. Nac. Hist. Nat. B. A. xxix. 242 (1917); Castellanos, Brom. Arg. iv., in An. Mus. Nac. Hist. Nat. B. A. xxxvii. 498 (1933).—Pl. IV, figs. 8–9.

ARGENTINA: TUCUMÁN: near Tucumán, 1926, *Schreiter 26/2374* (Castellanos!); LA RIOJA: valley of Famatina, 1879, *Hieronymus & Niederlein 850* (B, TYPE; phot. G); Nonogasta, 1927, *Castellanos 27/1908* (Castellanos!); General Roca, San Francisco, 1928, *Gomez 28/743* (Castellanos!); CÓRDOBA: Chacrarita de los Padres, Quebrada de la Tala, *Lorentz & Hieronymus* (Mez!); Sierra Chica, "El Zapato," near Capilla del Monte, alt. ca. 1000 m., 1918, *Osten 13471* (Ost); dept. San Javier, Yacanto, 1920, *Hauman 1123* (Castellanos!); near Villa Dolores, 1920, *Castellanos 1577* (Castellanos!); Achala, 1920, *Castellanos* (Castellanos!); indefinite, *Lossen 253* (G, FM, Mo); SAN LUIS: San Francisco, quebrada de Ramo, 1925, *Castellanos 25/623* (Castellanos!); Luján, quebrada de las Higueras, 1925, *Castellanos 25/622* (Castellanos!); Cerro Varela, 1925, *Castellanos 25/2790* (Castellanos!); Nogolí, 1925, *Castellanos 25/630* (Castellanos!); Santa Rosa del Gigante, 1926, *Castellanos 26/2046* (Castellanos!).

As Mez has already pointed out this species is in many ways intermediate between *T. bryoides* and *T. rectangula* and possibly may be a hybrid between the two. Certainly it appears to be much less frequent than either of its supposed parents and its range appears to be contained within theirs, but as yet there is no direct evidence to support the conclusion.

Mez cites the floral bract as being 7-nerved while I can find but 3. This may possibly be explained from the fact that the bract is so transparent that the nerves of the sepals underneath show through and from many angles of view appear to belong to the bract itself.

30. **Tillandsia** (§ **Diaphoranthema**) **angulosa** Mez. Plant pulvinate: stem less than 25 mm. long: roots present: leaves distichous or polystichous, up to 15 mm. long, densely and coarsely appressed-cinereous-lepidote; sheaths suborbicular, thin, many-nerved, glabrous only at extreme base; blades spreading to recurved, triangular, stout, angled, mucronate: scape very short and hidden by the leaves but bearing a single ovate acute prominently nerved densely lepidote bract: inflorescence always 1-flowered; floral bract like the scape-bract, slightly shorter than the sepals, at least 5-nerved: sepals elliptic, acute, 10 mm. long, prominently nerved, thin, often scantly lepidote, subfree: capsule slenderly subcylindric, abruptly short-beaked, 2 cm. long.—Epiphytic; northwestern Argentina.—Mez in DC. Mon. Phan. ix. 868 (1896); Hauman & Vanderveken, Phan. L'Arg. i., in An. Mus. Nac. Hist. Nat. B. A. xxix. 242 (1917).—Pl. IV, fig. 16.

ARGENTINA: LA RIOJA: Valle de Famatina, 1879, *Hieronymus & Niederlein 851* (B, TYPE; phot. G).

Mez considered that this species might be a hybrid of *T. retorta* and *T. bryoides*, and it seems very likely not only because of the way it combines the characters of the two but also in its lack of constancy in such traits as the arrangement of the leaves.

31. **Tillandsia** (§ **Diaphoranthema**) **rectangula** Bak. Plant small: stems many from a single point, forming a dense globose mass, up to 5 or rarely 7 cm. long, much branched: roots present: leaves densely distichous but often appearing polystichous due to the torsion and crowding of the stems, rarely over 2 cm. long; sheaths distinct, suborbicular, ca. 6 mm. long, glabrous except for the extreme apex, densely imbricate making the stem appear stout, scarious, several-nerved with broad nerveless margins; blades spreading or recurved, more or less contorted, triangular-subulate, 2 mm. thick, strongly angled, often distinctly keeled below, convolute above, acuminate, densely cinereous-lepidote with small nearly symmetrical subappressed

to reflexed-pruinose scales: scape distinct or almost none, slender, erect or ascending, up to 4 cm. long (Mez!) but usually not over 2 cm., apparently always terminal, glabrous, strongly angled, naked for most of its length or sometimes bearing an involute-clasping bract midway; scape-bracts lanceolate, acute or obtuse, several-nerved, even, subcoriaceous, glabrous or occasionally pale-appressed-lepidote, usually 2 in number, one at the extreme base of the scape and mostly hidden by the leaves, the other just below the inflorescence: inflorescence always of a single flower; floral bract like the upper scape-bract but smaller, much shorter than the sepals: flower subsessile, sepals elliptic-lanceolate, up to 10 mm. long, acute or obtuse, chartaceous, even, several-nerved, glabrous or scantly pale-lepidote, equally connate for about 2 mm. or the posterior suture barely longer than the 2 anterior ones; petals yellow (Osten!), 4.5 mm. longer than the sepals, blade subrhombic, obtuse, spreading at anthesis; stamens included, anthers basifixed, linear, obtuse, little more than 1 mm. long, filaments distinctly longer than the pistil; ovary subprismatic, tapering into the thick style, stigma capitate: capsule slenderly cylindric, up to 20 mm. long, abruptly contracted into a short beak.—Epiphytic and saxicolous; northern Argentina.—Bak. Journ. Bot. xvi. 238 (1878); xxv. 213 (1887); Hieron. Ic. & Descr. Argent. in Act. Acad. Cien. Cordoba, ii. 17 (1885); Bak. Brom. 160 (1889); Mez in DC. Mon. Phan. ix. 867 (1896); Hauman & Vanderveken, Phan. L'Arg. i., in An. Mus. Nac. Hist. Nat. B. A. xxix. 247 (1917); Castellanos, Brom. Arg. iv., in An. Mus. Nac. Hist. Nat. B. A. xxxvii. 506 (1933). *T. propinqua* Gay var. *rectangula* Griseb. Symb. Argent. in Goett. Abh. xxiv. 335 (1879).—Pl. IV, fig. 19.

ARGENTINA: SALTA: Orán, 1906, *Spegazzini* (Castellanos!); CATAMARCA: near Recreo, *Tatter in herb. Kurtz 4333* (Mez!); CÓRDOBA: near Córdoba, *Lorentz 127 in part* (K, TYPE; phot. G); *126 in part* (BM); *Hieronymus 483* (FM); Sierra Chica, "El Zapato," near Capilla del Monte, alt. ca. 1000 m., 1918, *Osten 13472* (Ost); same, "Los Paredones," *Osten 13473* (Ost); same, 1923, *Osten 17764* (Ost); same, 1922, *Castellanos 1579* (G); dept. San Alberto, Yacanto, 1924, *Castellanos 1564* (G); near Merced, 1881, *Hieronymus* (US); indefinite, *Lossen 190* (G, FM, Mo, Mun); SAN LUIS: Bajo de Velis, 1895, *Kurtz 8472* (Castellanos!); San Francisco, Quebrada de Ramo, 1925, *Castellanos* (BA 25/624, G).

32. **Tillandsia** (§ **Diaphoranthema**) **Castellani** L. B. Smith. Plant up to 15 cm. high when in flower: stems simple or few-branched, many from a single point: roots present: leaves densely distichous, up to 45 mm. long; sheaths broadly ovate, strongly nerved, densely lepidote with a ciliate margin of elongate scales; blades spreading or reflexed, sublinear, terete, 2–3 mm. in diameter, pungent, densely

pruinose-lepidote with cinereous scales: scape evident, terminal or pseudo-axillary, naked, glabrous, slender: inflorescence 1–2-flowered; floral bracts ovate, broadly acute, glabrous, strongly nerved, distinctly shorter than the sepals: flowers subsessile; sepals equally subfree, lanceolate, acute or obtuse, up to 9 mm. long, glabrous, strongly nerved; petals, stamens and pistil unknown: capsule slenderly cylindric, 15–25 mm. long.—Saxicolous; northern Argentina.—L. B. Smith in Contrib. Gray Herb. civ. 80, t. 3, figs. 17–19 (1934).

ARGENTINA: Córdoba: Capilla del Monte, Los Paredones, 1922, *Castellanos 1576* (G, type); same, alt. ca. 1000 m., 1918, *Osten 13474* (Ost); Cuesta de Atlantina, 1921, *Castellanos* (G); San Luis: Quebrada de Ramo in San Francisco, 1925, *Castellanos in hb. BA 25/618* (G).

33. **Tillandsia** (§ **Diaphoranthema**) **Gilliesii** Bak. Plant over 2 dm. long when in flower: stems many from a single point, forming a dense subglobose mass, up to 8 cm. long, simple or few-branched: roots present: leaves very densely distichous, 2–8 cm. long, densely subappressed-lepidote with cinereous to ferrugineous subsymmetrical scales; sheaths broadly oblong, many-nerved with no distinct margin, merging imperceptibly with the blade, lepidote except for the extreme base, densely imbricate making the stem appear 5–7 mm. thick, not overlapping behind the stem except at the extreme base; blades arching-recurved, often somewhat contorted, narrowly triangular, much compressed laterally, acuminate, with a very narrow triangular channel on the upper side: scape distinct or almost lacking, terminal or pseudoaxillary, up to 13 cm. long, appressed-lepidote, naked or bearing a single lanceolate involute bract: inflorescence 1–3-flowered, up to 38 mm. long, densely cinereous-lepidote; rhachis flexuous; floral bracts erect, lance-ovate, acute, up to 20 mm. long, equaling or exceeding the sepals or the uppermost sometimes slightly shorter, not more than twice as long as the internodes, not at all keeled, many-nerved, thin: flowers subsessile; sepals oblong-lanceolate, acute or obtuse, up to 16 mm. long, thin, many-nerved, lepidote, equally subfree; petals narrow; stamens deeply included, exceeding the pistil; ovary subglobose, slightly longer than the style: capsule slenderly cylindric, 25 mm. long, abruptly short-beaked.—Epiphytic; southern Peru and Bolivia, northern Argentina.—Bak. in Journ. Bot. xvi. 240 (1878); xxv. 213 (1887); Brom. 162 (1889); Castellanos, Brom. Arg. iv., in An. Mus. Nac. Hist. Nat. B. A. xxxvii. 503 (1933). *T. compressa* Gillies ex Bak. in Journ. Bot. xvi. 240 (1878), in synon, non Bertero. *T. andicola* Gill. sensu Wittm. in Reiss & Steubel, Todtenfeld v. Ancon, t. 106, fig. 15 (non Gill.)—Pl. IV, figs. 10–12.

PERU: AREQUIPA: below Tingo, 1914, *Mr. & Mrs. J. N. Rose 19014* (US, NY); Arequipa, alt. 2500 m., 1926, *G. H. H. Tate 1196* (NY). BOLIVIA: CHUQUISACA: prov. Cinti, Puca Khasa, near Tacaquira, 1934, *Hammarlund 313* (S); Camataqui, alt. 1800 m., 1932, *Cardenas 214* (G). ARGENTINA: SALTA: Molinos, 1897, *Spegazzini 203* (Castellanos!); TUCUMAN: Valle de Santa Maria, Quebrada de Las Arcas, 1920, *Schreiter 1365* (Castellanos!); between Amaicha and Tiopunco, 1931, *Schreiter 7340* (Castellanos!); CATAMARCA: Quebrada de San Buenaventura, 1930, *Castellanos in hb. BA 30/409* (Castellanos!); LA RIOJA: Sierra Velazco, Los Colorados, 1879, *Hieronymus & Niederlein 508* (Castellanos!); Nonogasta, 1927, *Castellanos in hb. BA 27/1905* (G); SAN JUAN: Sierra Pie de Palo, 1896, *Spegazzini 204* (Castellanos!); MENDOZA: foot of the cordillera near Mendoza, 1825, *Gillies* (K, TYPE; G, Cam); Precordillera, 1906, *Carette 1126* (Castellanos!); near Mendoza, 1914, *Sanzin 1125* (Castellanos!); Pilar, 1916, *Ruiz 324* (Castellanos!); BUENOS AIRES: Sierra Ventana, 1881, *Lorentz* (Ost, US); LA PAMPA: Naicó, 1927, *Castellanos in hb. BA 27/2880* (G).

Castellanos has reërected this species, which Mez reduced to the synonymy of *T. myosura*. As he did not publish his reasons in treating *T. Gilliesii*, I am taking the liberty of so doing here and illustrating from some excellent living material he sent.

T. Gilliesii has leaves that are much compressed laterally and leaf-sheaths that show no distinction from the blades except their position, while *T. myosura* has leaves that are practically terete and leaf-sheaths that are noticeably broader than the blades. Also the sheaths in *T. Gilliesii* have margins barely overlapping, while in *T. myosura* they are strongly so (see Pl. IV, figs. 11 & 14).

The type sheet of *T. Gilliesii* shows the whole range of variation from the longest scape recorded to practically none.

34. **Tillandsiia** (§ **Diaphoranthema**) **myosura** Griseb. Plant large for the section *Diaphoranthema*, flowering specimens occasionally 3 dm. or more high: stems many from a single point, forming a dense subglobose mass, up to 10 cm. long but usually only about 6 cm., simple or few-branched: roots present: leaves densely distichous, 5–17 cm. long; sheaths distinct, suborbicular to reniform, 10–15 mm. long, normally with the upper half densely lepidote like the blade but sometimes wholly glabrous, even in the glabrous phase with a fringe of narrow marginal scales, densely imbricate making the stem appear 5–8 mm. thick, their margins overlapping behind the stem for most of their length; blades strongly recurved and more or less contorted, triangular-subulate, 3–5 mm. in diameter, evenly rounded when fresh with a channel along most of the upper side, becoming strongly sulcate when dry due to the shrinkage of tissue between the nerves, acuminate, densely cinereous-lepidote with small basally produced subappressed to reflexed-pruinose scales: scape always distinct, erect, terminal, up to 20 cm. long, lepidote or glabrous, naked or with a

single lanceolate involute lepidote bract well removed from the inflorescence: inflorescence linear, up to 8 cm. long, laxly 1–8-flowered, densely cinereous-lepidote; rhachis slender, flexuous in the few-flowered specimens, but usually geniculate in the larger ones; floral bracts remote, rarely more than twice as long as the internodes and often much less, particularly in the many-flowered specimens, closely enfolding the calyx, not concealing the rhachis except by their extreme base, broadly ovate, acuminate, up to 21 mm. long, the lower ones equaling or exceeding the sepals, the upper ones often distinctly shorter, chartaceous, prominently many-nerved: flowers erect, closely appressed to the rhachis, subsessile; sepals oblong-lanceolate, acute or obtuse, 9–15 mm. long, thin, many-nerved, usually more or less lepidote, equally subfree; petals linear, up to 20 mm. long, yellowish white; stamens deeply included, exceeding the pistil; style short-cylindric, about as long as the ovary: capsule cylindric, abruptly short-beaked, up to 35 mm. long.—Epiphytic; southern Bolivia, Uruguay and northern Argentina.—Griseb. ex Bak. in Journ. Bot. xvi. 240 (1878); xxv. 213 (1887); Griseb. Symb. Argent. in Goett. Abh. xxiv. 333 (1879); Wittm. in Engl. & Prantl, Nat. Pflanzenf. ii. Abt. 4, 56 (1888); Bak. Brom. 163 (1889); Mez in DC. Mon. Phan. ix. 869 (1896); O. Ktze. Rev. Gen. iii. 304 (1898); Hauman & Vanderveken, Phan. L'Arg. i., in An. Mus. Nac. Hist. Nat. B. A. xxix. 245 (1917); Harms in Engl. & Prantl, Nat. Pflanzenf. ed. 2, xv a. 122 (1930); Herter, Florula Urug. 45 (1930); L. B. Smith, Not. Brom. in Ostenia, 361 (1933). *Tillandsia Nappii* Lorentz & Niederlein in Roca Exped. Rio Negro, ii. 282 (1881).—Pl. IV, figs. 13–15.

BOLIVIA: Potosi: dry *Mimosa*-forest formation, alt. 2600 m., 1927, *C. Troll 3369* (Mun). URUGUAY: 1890, *André K 326* (G). ARGENTINA: Salta: Cerro San Bernardo, 1919, *Hauman 1567* (G); dept. Guachipas, Alemania, alt. 1300 m., 1929, *Venturi 9977* (G, US); Tucuman: dept. Trancas, Tapia, 1919, *Schreiter 1029* (G); same, alt. 700 m., 1920, *Venturi 1178* (Ost); dept. Trancas, Vipos, 1921, *Schreiter in hb. BA 27/2336, 27/2348* (G); same, alt. 786 m., 1923, *Schreiter 2032* (Ost); Catamarca: Cerro del Arenal, 1917, *Jörgensen 1772* (G, US, Mo, Ost); La Rioja: dept. Famatina, Guanchin, alt. 1600 m., 1928, *Venturi 8096* (G); Córdoba: Estancia Germania near Cordoba, 1874, *Lorentz 122* (BM, type; B, phot. G, NY); Chacra de La Merced, 1881, *Hieronymus* (NY, S); Los Paredones near Capilla del Monte, alt. ca. 1000 m., 1918, *Osten 13480, 13481* (Ost); same, 1922, *Castellanos 1570* (G); Valle de Los Reartes, 1919, *Castellanos* (G, US, FM, Ost).

The original description of this species was drawn up by Baker and was based directly on the exsiccatae name on *Lorentz 122* from Cordoba. Grisebach republished the name a year later and based it on two collections. Then Lorentz and Niederlein distinguished these collections as separate species but gave the new name, *T. Nappii*, to that collection which was already the type of *T. myosura*. Thus *T. Nappii* must inevitably fall into synonymy and whoever wishes to consider the two collections distinct species must propose another name for the second collection.

From an examination of the material cited above it appears that the distinctions proposed by Lorentz and Niederlein are of no value. The character of glabrous leaf-sheaths is often striking but may show transition to the lepidote type on a single plant. The indument on the scape is extremely variable and shows no correlation with other characters. It is a result of age and probably of habitat also.

The specimens with glabrous leaf-sheaths approach *T. retorta* in habit, and may possibly represent hybrids with the latter species.

35. **Tillandsia** (§ **Diaphoranthema**) **retorta** Griseb. Plant up to 15 cm. long when in flower but usually only half that long: stems many from a single point, forming a dense globose mass, usually much branched, 2–8 cm. long: roots present: leaves distichous, 3–5 cm. rarely up to 7 cm. long, densely cinereous-lepidote; sheaths suborbicular, prominently nerved with broad nerveless margins, normally glabrous with a ciliate margin of elongate scales but occasionally as lepidote as the blades, imbricate and making the stem appear 3–5 mm. thick; blades recurved and contorted, slender, terete, acuminate-pungent, barely over 2 mm. thick, prominently nerved when dry: scape terminal or pseudo-axillary, from almost none to 55 mm. long, but usually quite short, slender, densely lepidote, naked: inflorescence 1–2-flowered, densely cinereous-lepidote; rhachis produced behind the terminal flower; floral bracts erect, ovate, acute or acuminate, 10–12 mm. long, equaling or exceeding the sepals, slightly more than twice as long as the internodes in the several-flowered specimens, prominently nerved: flowers subsessile; sepals lance-oblong, acute, 10 mm. long, thin, prominently nerved, lepidote, much connate posteriorly; petals yellow (Venturi!), blade distinct, narrowly elliptic, 6 mm. long, much firmer than the claw; stamens deeply included, exceeding the pistil; ovary ellipsoid, stipitate, slightly shorter than the style, stigma capitate: capsule slenderly cylindric, abruptly short-beaked, 25–30 mm. long.—Epiphytic; northern Argentina.—Griseb. ex Bak. in Journ. Bot. xvi. 238 (1878); xxv. 213 (1887); Griseb. Symb. Argent. in Goett. Abh. xxiv. 334 (1879); Bak. Brom. 162 (1889); Mez in DC. Mon. Phan. ix. 868 (1896); O. Ktze. Rev. Gen. iii. 304 (1898); Spegazzini, Nov. Add. in An. Mus. Nac. B. A. ser. 2, iv. 171 (1902); Macloskie Rep. Princeton Univ. Exped. Patagonia, viii. 294 (1904); Hauman & Vanderveken, Phan. L'Arg. i., in An. Mus. Nac. Hist. Nat.

B. A. xxix. 247 (1917); Castellanos, Brom. Arg. iv., in An. Mus. Nac. Hist. Nat. B. A. xxxvii. 506 (1933). *T. caespitosa* Gill. ex Bak. in Journ. Bot. xvi. 238 (1878), in synon. non LeConte. *T. Nappii* var. *Darwinii* Lorentz & Niederlein in Roca Exped. Rio Negro, ii. 282 (1881); Castellanos Brom. Arg. i., in Com. Mus. Nac. Hist. Nat. B. A. ii. 143 (1925).—Pl. IV, fig. 20.

ARGENTINA: TUCUMAN: dept. Trancas, between Tapia and Cadillal, alt. 700 m., 1920, *Venturi 1029 in part* (G); same, 1924, *Schreiter 4165* (Castellanos!); Vipos, alt. 786 m., 1923, *Schreiter 1368 in part* (Ost); same, 1921, *Schreiter 6599 in part* (Castellanos!); same, alt. 850 m., 1921, *Venturi 1371* (US); between Tapia and Raco, 1920, *Schreiter 1368 in part* (Castellanos!); Tapia, 1923, *Schreiter 6599 in part* (Castellanos!); Trancas, 1924, *Venturi 1029 in part; 2492; 3522* (Castellanos!); SANTIAGO DEL ESTERO: 1910, *Willis* (US); CÓRDOBA: Estancia Germania near Córdoba, *Lorentz 125* (BM, TYPE); near Córdoba, 1871, *Lorentz 70* (US); 1877, *Hieronymus 484* (US); Chacra de La Merced near Córdoba, 1881, *Hieronymus* (G, B, NY, SP); Sierra de Córdoba, 1875–6, *Hieronymus 348* (B); Cuesta de Las Minas, Potrero de Garay, Anisacate, 1895, *Kurtz 8626a* (NY, MN Rio); Dean Funes, 1916, *Sanzin 1158* (Ost); Sierra Chica, La Falda, alt. ca. 1000 m., 1918, *Osten 13458* (Ost); same, Los Paredones near Capilla del Monte, *Osten 13479* (Ost); same, Valle Hermoso, alt. ca. 950 m., *Osten 13484* (Ost, S); same, Rio Pintos, alt. 1000 m., *Osten 13493* (Ost); indefinite, 1877, *Hieronymus* (BM); *9; 146* (Mez!); *Lorentz 97* (Mez!); *Kurtz 1152, 6607* (Mez!); SAN LUIS: Alto de las Jarillas, 1882, *Galander 25* (B); Quebrada del Salado near La Bebida de Las Vacas, 1882, *Galander* (BM, S); MENDOZA: 1825, *Gillies* (K, type of *T. caespitosa;* Cam, G); San Rafael, Cañada Seca, 1921, *Ruiz in hb. BA 25/1862* (G); BUENOS AIRES: Laguna Salada de Narracó, 1879, *Lorentz & Niederlein* (B, type of *T. Nappii* var. *Darwinii;* phot. G); near Carmen de Patagones, *Spegazzini* (Spegazzini!); LA PAMPA: Naicó, 1931, *Monticelli* (Castellanos!); INDEFINITE: *Miers 1366* (BM).

Tillandsia retorta apparently forms frequent hybrids with other species. The probability of its crossing with *T. myosura* has already been noted. In hb. Osten, *Venturi 1371* from Vipos, Tucuman, is intermediate between the two having leaf-sheaths like typical *T. retorta* but a 3-flowered inflorescence and sepals that are sometimes equally subfree and sometimes posteriorly connate. Another specimen in hb. Osten, *Osten 13478,* was collected between specimens of *T. retorta* (*Osten 13479*) and *T. Castellani* (*Osten 13474*) and is evidently a hybrid of the two.

36. **Tillandsia** (§ **Diaphoranthema**) **andicola** Gillies. Plant up to 3 dm. long when in flower: stem more than 2 dm. long, much more than half the total length of the plant and several times longer than the leaves thus giving the plant a very distinctive habit, branching particularly near the apex: roots present: leaves rather laxly distichous or polystichous, up to 6 cm. long but usually only about 4 cm., densely subappressed-lepidote with basally produced cinereous scales; sheaths about 5 mm. apart on the stem, making the stem appear 3–4

mm. thick, suborbicular, much broader than the blades, several-nerved with a broad nerveless margin, ciliate with elongate scales, usually lepidote except for the extreme base, occasionally with a narrow glabrous strip next the margin or wholly glabrous in extreme age; blades recurving and more or less contorted, 2 mm. thick but acuminate and pungent, terete, strongly nerved when dry: scape terminal or pseudo-axillary, from almost none to 6 cm. long, densely lepidote, naked or with a single lanceolate involute acuminate lepidote bract: inflorescence 1- or rarely 2-flowered, densely lepidote; rhachis produced behind the terminal flower; floral bract lance-ovate, acuminate, up to 14 mm. long, exceeding the sepals, twice as long as the internode and not concealing the rhachis in the 2-flowered specimen, prominently nerved, not at all keeled, closely enfolding the calyx: flowers subsessile; sepals lance-oblong, acute, 11 mm. long, prominently nerved, joined posteriorly for half their length; petals narrow; stamens deeply included, exceeding the pistil.—Northwestern Argentina.—Gillies ex Bak. in Journ. Bot. xvi. 239 (1878); xxv. 213 (1887); Bak. Brom. 161 (1889); Mez in DC. Mon. Phan. ix. 871 (1896); Macloskie, Rep. Princeton Univ. Exped. Patagonia, viii. 293 (1904); Hauman & Vanderveken, Phan. L'Arg. i., in An. Mus. Nac. Hist. Nat. B. A. xxix. 242 (1917); Castellanos, Brom. Arg. iv., in An. Mus. Nac. Hist. Nat. B. A. xxxvii. 498 (1933).—Pl. IV, fig. 18.

ARGENTINA: CATAMARCA: Cuesta de La Chilca, Agua de La Chilca, 1930, *Schreiter 1136* (G); MENDOZA: Andes of Mendoza, *Gillies* (K, TYPE; Cam, G); Crucesita, 1906, *Carette 1186* (G).

37. **Tillandsia** (§ **Diaphoranthema**) **Landbeckii** Phil. Plant up to 3 dm. long when in flower: stems densely massed, usually much branched, up to 2 dm. long, slender: roots present in small specimens, but apparently often lost in later development: leaves laxly distichous, 6–12 cm. long, densely subpruinose-lepidote with fine cinereous scales; sheaths elliptic, thin, few-nerved, densely lepidote except at the extreme base, 10–15 mm. long, laxly imbricate making the stem appear 2–4 mm. thick; blades more or less spreading, linear, terete, 1–1.5 mm. thick, soft with a weak point: scape terminal, erect, always prominent, up to 10 cm. long, 1 mm. or less in diameter, densely cinereous-lepidote; scape-bracts 2 or 3, immediately below the inflorescence, linear-lanceolate, acuminate or caudate-appendaged, densely lepidote: inflorescence 1–2-flowered; floral bracts like the scape-bracts but smaller, about equaling the sepals, pink (Murphy!) drying to violet: flowers subsessile, the second when present very close to the first; sepals elliptic, acute, 10 mm. long, thin, prominently

nerved, sparsely lepidote, equally subfree; petals ligulate, obtuse, yellow when dry; stamens deeply included, slightly exceeding the pistil; ovary about as long as the style: capsule slenderly cylindric, abruptly short-beaked, 22 mm. long.—Terrestrial and epiphytic; along the coast from Ecuador to northern Chile.—Phil. in Linnaea, xxxiii. 248 (1864), An. Univ. Chile, lix. 323 (1881); Cat. Pl. Chil. 279 (1881); Mez in DC. Mon. Phan. ix. 872 (1896); Reiche, Pflanzenverbreit. Chile in Engl. & Drude, Veg. d. Erde, viii. 178 (1907); I. M. Johnston in Contrib. Gray Herb. lxxxv. 22 (1929); Harms in Engl. & Prantl, Nat. Pflanzenf. ed. 2, xv a. 122 (1930); Reiche & Looser, Geog. Bot. Chile, 295 (1934). *T. recurvata* aut. non L.; Bak. in Journ. Bot. xvi. 239 (1878), in part; Brom. 162 (1889); L. B. Smith ex I. M. Johnston in Contrib. Gray Herb. xcv. 31 (1931).—Pl. IV, fig. 17.

ECUADOR: without definite locality, *Lehmann* (Mez!). PERU: ICA: foggy crests of San Gallan Island, clinging to lee-sides of rocks, alt. 300–440 m., 1919, *R. C. Murphy 3468* (G, Brooklyn); Viejas Island, on crumbling rocks at summit, 1919, *R. C. Murphy 3221* (Brooklyn). CHILE: ANTOFAGASTA: dept. Taltal, on shrubs and cactus on summit ridge, Cerro Perales ("Cerro del Hueso Parado" of Philippi) near Taltal, ca. lat. 25° 24′ S., alt. ca. 1000 m., 1925, *I. M. Johnston 5624* (G); ATACAMA: dept. Copiapó, vicinity of Caldera, Cerros de Copiapó, 1885, *E. E. Gigoux 59* (G); hills north of Copiapó, alt. ca. 800 m., 1925, *I. M. Johnston 5022* (G); COQUIMBO: Illapel, 1862, *Landbeck* (G, part of TYPE); same, *Philippi 969* (Bo); Choapa, *Philippi* (BM, DH).

38. **Tillandsia** (§ **Diaphoranthema**) **recurvata** L. Plant somewhat variable, 4–23 cm. long when in flower: stems densely massed, simple or few-branched, 1–10 cm. long, typically much shorter than the leaves but occasionally about equaling them: roots present: leaves distichous, 3–17 cm. long, densely pruinose-lepidote with cinereous or ferruginous scales; sheaths elliptic-ovate, thin, many-nerved with a broad hyaline nerveless margin, the extreme base glabrous, elsewhere densely lepidote and with a ciliate margin of elongate scales, imbricate and completely concealing the stem; blades typically recurved, sometimes only spreading or even erect, linear, terete, 0.5–2 mm. in diameter, rather soft with a weak point: scape terminal, always prominent, up to 13 cm. long, ca. 0.5 mm. in diameter; scape-bracts linear-lanceolate, lepidote, 1 or very rarely 2 immediately below the infloresecnce, sometimes one next the inflorescence and one remote: inflorescence typically 1–2- rarely up to 5-flowered, dense; floral bracts like the scape-bracts but smaller, typically equaling or longer than the sepals but often distinctly shorter, several-nerved, densely lepidote: flowers erect, subsessile; sepals lanceolate, usually acute, 4–9 mm. long, equally subfree, thin with 3 or more prominent nerves, typically glabrous but towards its southern limits somewhat

lepidote in an increasing proportion of specimens; petals narrow, pale violet or white, blade narrowly elliptic, obtuse; stamens deeply included, exceeding the pistil: capsule slenderly cylindric, abruptly short-beaked, up to 3 cm. long.—Terrestrial and epiphytic; southeastern United States to northern Argentina and Chile.—Sp. Pl. ed. 2, 410 (1762); Lam. Encycl. i. 618 (1785); Sw. Obs. Bot. 121 (1791); Willd. Spec. ii. 14 (1799); R. & P. Fl. Peruv. iii. 42, t. 271, fig. a (1802); Michx. Fl. Bor.-Am. i. 195 (1803); Ait. Hort. Kew, ed. 2, ii. 204 (1811); Pursh, Fl. Sept.-Am. i. 217 (1814); HBK. Nov. Gen. i. 291 (1816); Meyer, Fl. Esseq. 146 (1818); Nutt. Gen. i. 208 (1818); Lk. Enum. i. 308 (1821); LeC. in Ann. Lyc. Nat. Hist. N. Y. ii. 132 (1828); R. & S. Syst. vii. 1202 (1830); Gris. Fl. Br. W. Ind. 598 (1864); Chapm. Fl. South. U. S. 472 (1860); Bak. in Journ. Bot. xvi. 239 (1878); xxv. 213 (1887); Benth. & Hook. Gen. iii. 669 (1883); Hemsl. Biol. Centr.-Am. iii. 321 (1884); Wittm. in Engl. & Prantl, Pflanzenf. ii. Abt. 4, 56 (1888); Bak. Brom. 162 (1889); Mez in Mart. Fl. Bras. iii. pt. 3, 609 (1894); Mez in DC. Mon. Phan. ix. 872 (1896); Small, Fl. s. e. U. S. 245 (1903); W. J. Birge, Bull. Univ. Texas, no. 194 (1911); Boldingh, Fl. Ned. W.-I. 144 (1913); Hassler, Cons. & Jard. Bot. Genève, xx. 335 (1919); Britton & Wilson, Bot. P. Rico, v. 141 (1923); Herter, Fl. Urug. 45 (1930); Harms in Engl. & Prantl; Nat. Pflanzenf. ed. 2, xv a. 122 (1930); Standl. Field Mus. Pub. Bot. iii. 222 (1930); Castellanos, Physis, x. 88 (1930); An. Mus. Nac. Hist. Nat. B. A. xxxvii. 506 (1933). *Viscum Caryophylloides minus foliis pruinae instar candicantibus, flore tripetalo purpureo semine filamentoso* Sloane, Cat. 77 (1696); Ray, Hist. Pl. Suppl. 406 (1704); Sloane, Hist. i. 190, t. 121, fig. 1 (1707). *Renealmia foliis subulatis scabris; pedunculis unifloris* Royen, Lugd.-Bat. 25 (1740). *R. recurvata* L. Sp. Pl. 287 (1753), excl. var. β. *Tillandsia parasitica parva, pruinosa, scapo tenui bifloro* Browne, Jam. 194 (1756). *T. uniflora* HBK. Nov. Gen. i. 290 (1816). *Diaphoranthema uniflora* Beer, Brom. 154 (1857). *D. recurvata* ibid. 156. *Tillandsia monostachys* Gill. ex Bak. in Journ. Bot. xvi. 239 (1878), in synon., non L. *T. recurvata* forma *genuina* André, Brom. Andr. 65 (1889); formae *elongata, major, minor, contorta, caespitosa, brevifolia, argentea* ibid. *T. recurvata* var. *ciliata* E. Morr. ex Mez in Mart. Fl. Bras. iii. pt. 3, 610 (1894); var. *contorta* André ex Mez, ibid. 611; var. *minuta* Mez, ibid. *Phytarhiza ciliata* E. Morr. ex Mez in Mart. Fl. Bras. iii. pt. 3, 610 (1894), in synon. *T. cordobensis* Hieron. sensu Hassler, Fl. Pilc. in Trab. Mus. Farm. B. A. xxi. 41 (1909), non Hieron.—Ball moss; Bunch moss; Old man's beard; Nidos de gungulen (Porto Rico); Barba die Kadoesji and Marie die paaloe (Dutch West Indies).

UNITED STATES: Florida: Duval Co.: Jacksonville, *Curtiss 2849* (G, BM, NY); *4141* (DH, NY); *5054* (G, NY); St. Nicolas, *Lighthipe 624* (NY); Alachua Co.: Gainesville, *Garber* (G); *S. J. Knight 2* (NY); Volusia Co.: De Land, *G. B. Grant 1223* (NY); Lake Co.: Eustis, *Nash 1372* (G, NY); *Underwood 1352* (NY); Orange Co.: Orlando, *Canby* (G); *Harper 9* (G, NY); *Moldenke 5329* (NY); Brevard Co.: Merritts Island, *Curtiss 5772* (G, NY, Pom); Okeechobee region, *Fredholm 6058* (G); Pasco Co.: Odessa, *Blanton 6924* (Bailey); Pinellas Co.: Dunedin, *Tracy 6749* (G, NY); Lee Co.: Fort Myers, *Hitchcock 345* (G, NY); La Costa Island, *J. H. Simpson 360* (DH); Dade Co.: Miami, *Moldenke 535* (NY, S); Sykes Hammock, *Small, Mosier & Simpson 5776* (NY, S); Nixon-Lewis Hammock, *Small & Mosier 5886* (NY, S); Monroe Co.: Long Key, *Tracy 7521* (G, BM, NY); Key Largo, *Small & Carter 3117* (NY); indefinite: *Chapman* (NY); *Rugel 362* (NY, Pom); *Leavenworth* (G, NY); Texas: Travis Co.: Austin, *G. W. Letterman* (DH, NY, FM); *Rose & Russell 24130* (G); *H. H. York 52* (DH); Blanco Co.: Blanco, *E. J. Palmer 33962* (Mo, G, NY); Hays Co.: San Marcos, *Trelease* (Mo); Val Verde Co.: Devil River between Ozona and Comstock, *Ferris & Duncan 3037* (NY, Mo, DH, Pom); Brewster Co.: Chisos Mts., *C. H. Mueller 8576* (G, FM); *Ferris & Duncan 2801* (Mo, DH, NY); *Moore & Steyermark 3198* (G, NY); Comal Co.: New Braunfels, *Lindheimer 226* (G); *539* (G, NY, FM, Mo, Pom); *1200; 1201* (G, NY, FM, Mo, BM); Bandera Co.: *Reverchon 950* (Mo); Bexar Co.: San Antonio, *B. F. Bush 1271* (NY, Mo); *J. Clemens 144* (NY); *Farlow* (G); *G. Jermy* (NY); Uvalde Co.: *Milligan* (US); Karnes Co.: Gillett, *Munz 1467* (Pom); Victoria Co.: Victoria, *E. J. Palmer 9069* (S, Mo); Bee Co.: Beeville, *Bencke 5346* (G, FM); Nueces Co.: Corpus Christi, *A. Heller 1400* (NY); *H. Ravenel 172* (NY, Mo); Cameron Co.: Brownsville, *Ferris & Duncan 3194* (Pom, DH, Mo); *H. C. Hanson 479* (NY); Arizona: Santa Cruz Co.: Atascosa Mts., 20 miles n. w. of Nogales, *Phillips* (US); Patagonia Mts., *Bartram & Peebles 10611* (US). MEXICO: Tamaulipas: San Fernando, *Berlandier 818; 2238* (G); Matamoros, *Gregg* (G); Jaumave, *Rozynski 120* (FM); *251* (G, FM); Nuevo Leon: Monterrey, *Gregg* (G); near Pueblo Galeana, *Mueller 325* (G); Coahuila: Jimulco, *Pringle 219* (G); Saltillo, *E. Palmer 428* (G); Chihuahua: Mapula Mts., *Pringle 801* (NY, Mo, FM, BM, S); Sonora: Alamos, 1890, *E. Palmer 372* (G); Cochuto, *Hartman 74* (G, FM); Baja California: Playa Maria, *Anthony 96* (G, NY, S, FM, Mo, Pom, DH); between San Lucas and Todos Santos, *G. F. Ferris* (DH); Loreto, *W. S. W. Kew* (US); Sinaloa: Labrados, *Ferris & Mexia 5121* (DH); Villa Union, *Rose, Standley & Russell 13978* (US, NY); Mazatlan, 1849, *Strickland* (BM); Durango: Durango, *E. Palmer 640* (G, NY, FM, Mo, UCal, BM, Bo); Zacatecas: Santa Rosa and Cedros, *Kirkwood 42* (G); near Cedros, *Kirkwood 200* (FM); *Lloyd 55* (G, Mo); San Luis Potosi: San Luis Potosi, *Parry & Palmer 872 1/2* (G); *Schaffner 225 1/2* (NY, FM); *530* (G); Charcas, *Lundell 5479* (G); Vera Cruz: Orizaba, *Mueller 1756* (G, NY); Panuco, 1910, *E. Palmer 372* (G, Mo); Zacuapan, *Purpus 8223* (G, NY, Mo); Perote, *Schiede & Deppe* (BM); Vera Cruz, *Houston* (Cam); San Francisco near Vera Cruz, *C. L. Smith 1325* (G); Guanajuato: Guanajuato, *Duges* (G); Aguascalientes: Aguascalientes, *Deam 156* (G, FM); *J. G. Smith 183* (Pom, Mo); Nayarit: Santiago Ixcuintla, *Ortega 6149* (G, DH); Jalisco: Tuxpan, *Mexia 1029-a* (G, NY, FM, Mo, BM); Colima: Manzanillo, *Trelease* (Mo); Michoacan: Chapultepec, *Brandegee* (UCal); Morelia, *Arsène 5361* (Mo); Mexico: Valley of Mexico, *Bourgeau 96* (G, S); Federal District: Mexico City, *Lemmon* (UCal); Morelos: Cuernavaca, *Fröderström & Hultén 62; 159* (S); Puebla: San Luis Tultitlanapa, *Purpus 3394* (G, NY, FM, Mo, BM); Puebla, *Arsène 47* (S, Mo); *1298; 1840* (G, Mo); *2194m* (BM); *10124* (US); Guerrero: Chilpanzingo, *Humboldt & Bonpland* (P, type of *T. uniflora;* phot. G); Oaxaca: Ocotlán, *Conzatti & Gonzalez 1277* (G); Valle de Oaxaca, *Conzatti & Gonzalez 1168* (G);

YUCATAN: Silam, *Gaumer 659* (G, NY, FM, Mo, BM); San Anselmo, *Gaumer 1912* (G, S, FM, Mo, DH, BM, BA); Chichankanab, *Gaumer 1913* (FM); Merida, *Schott 35* (BM, FM); Izamal, *Greenman 401* (FM); INDEFINITE: *Berlandier 191* (G); *367* (BM); *1451* (G). SALVADOR: SAN SALVADOR: San Salvador, *Caldéron 1505* (G, NY). NICARAGUA: MASAYA: Santiago Volcano, Masaya, *Maxon 7672* (US, NY). BAHAMAS: Eleuthera, *Britton & Millspaugh 5579* (NY, FM); Andros, *Brace 5051* (FM); *Northrop 617* (G, NY, FM); *Small & Carter 8652* (NY, FM); Cat Island, *Hitchcock* (FM); Watling's Island, *Britton & Millspaugh 6147* (NY, Mo); Great Exuma, *Britton & Millspaugh 3011* (G, NY, FM); Acklin's Island, *Brace 4450* (G, NY, FM); Inagua, *Nash & Taylor 914* (NY, FM). CUBA: ISLA DE PINOS: Sierra de Casas, *Ekman 12566* (S); Columbia, *Britton & Wilson 15634* (NY, FM); Caballos, *Jennings 194* (NY); PINAR DEL RIO: Pinar del Rio, *Palmer & Riley 77* (NY); Rio Portales, *Shafer 11196* (G, NY, Mo, FM); Los Palacios, *Shafer 11907* (NY); Sumidero, *Shafer 13379* (NY); Buenaventura, *Wilson 9353* (NY); Sierra de Anafe, *Wilson 11393* (NY); HAVANA: Sierra del Anafe, *Ekman 1122* (S); Guanabacoa, *Curtiss 586* (G, NY, FM, Mo, BM); Anafe, *Ekman 238* (G, FM, S); Arroyo Apulo, *Leon 637* (NY); Guines, *Van Hermann 190* (NY, FM); Santiago de las Vegas, *Van Hermann 392* (NY, FM); *704* (NY, FM, BM); MATANZAS: Matanzas, *Britton 240* (NY); Jumury, *Rugel 245* (NY, BM); SANTA CLARA: Rio San Juan, *Britton, Earle & Wilson 5848* (NY); Cieneguita, *Combs 580* (G, NY, FM, Mo); Soledad, *Jack 6220* (G, BA); *6268* (G); *6366* (G, S, FM); *6386*; *6472* (G); Las Vegas de Matagua, Buenos Aires, *Jack 8739* (S); Sancti Spiritus, *Shafer 12091* (NY); Rinco to Banao, *Shafer 12320* (NY); CAMAGUEY: Loma de Loro, *Shafer 2642* (G, NY, FM, BM); Cayos Canal Nuevo, *Shafer 2665* (G, NY, FM, BM); ORIENTE: *Wright 687* (G, NY, Mo, S); *688* (G); Santiago de Cuba, *Ekman 8013* (G, S); *Millspaugh 1016* (FM); Holguin, *Shafer 1257* (NY); Guantánamo, *Ekman 2851* (S); San Juan Hill, *Shafer 12423* (NY, Mo). JAMAICA: 1687–9, *Sloane* (BM, TYPE); 1780–2, *Shakespear* (BM); *Swartz* (S); Santa Cruz Mts., *Britton 1322* (NY); Luana Point, *Britton 1518* (NY); Kingston, *S. Brown 388* (NY); Kingston to Waureka, *Maxon 10526* (S); Balaclava, *Perkins 1417* (G); Heathshire Hills, *Harris & Britton 10511* (FM). HAITI: Grande Cayemite, *Eyerdam 322* (G, FM); Navassa Island, *Rehder 21* (G); St. Michel de l'Atalaye, *Leonard 7178a* (US); Bombardopolis, *Leonard 13462* (G, US); Port Margot, *Nash 902* (NY); San Michel, *Nash & Taylor 1402* (NY); Jaimel, *Xavier* (BM). SAN DOMINGO: Amouroux, *hb. Nolte* (BM); Azua, *Rose, Fitch & Russell 3840* (NY). PORTO RICO: Desecheo Island, *Britton, Cowell & Hess 1576* (NY); Mona Island, *Britton, Cowell & Hess 1813* (NY); *Stevens 6442* (NY); Mayaguez, *Cowell 506* (NY, FM); *Sintenis 265* (G, NY, Mo, FM, BM, S); Coarmo, *Goll, Cook & Collins 752* (NY); *Heller 512* (NY, FM); *Sintenis 3023* (NY, Trin); Cabo Rojo, *Heller 4427* (G, NY, FM, Mo); *Stevens 2260* (NY); Guayama, *Kuntze 552a* (NY); *Underwood & Griggs 427* (NY); Santa Rita, *Stevenson 2256* (G, FM). LESSER ANTILLES: ST. CROIX: *Ricksecker 272* (G, NY); *Bentzen 6* (S); *Hornbeck* (S); *Thompson 968* (S); ST. MARTIN: *Rijgersmaa* (S); *Boldingh 2620* (NY); ST. BARTHOLOMEW: *Euphrasen* (S); *Forsström* (S); ST. KITTS: *Britton & Cowell 461* (NY); NEVIS: *Tobin* (BM); ANTIGUA: *Gregory* (BM); *Rose, Fitch & Russell 3303* (NY); *Shafer 33* (NY); *Bailey 177* (Bailey); MONTSERRAT: *Shafer 69* (NY, FM); GUADELOUPE: *Duss 3401* (NY); MARTINIQUE: *Duss 992a* (G, NY, FM, Mo); *Hahn 1029* (US); *1052* (BM); *1555* (BM, S); BONAIRE: *Boldingh* (NY); CURAÇAO: *Britton & Shafer 3024* (NY, FM); *Curran & Haman 57* (G). VENEZUELA: BOLIVAR: Isla Degrero, near Ciudad Bolivar, *Bailey 1780* (Bailey); NUEVA ESPARTA: Coche Island, *J. R. Johnston 14* (G); Margarita Island, *J. R. Johnston 219* (G, NY); SUCRE: Cristobal Colon, *Broadway 815* (G, NY); DISTRITO FEDERAL: Caracas, *Allart 12* (NY); *Bailey 6* (G, Bailey); *Pittier*

9872 (G, NY); *11288* (NY); Cabo Blanco near La Guaira, *Curran & Haman 932* (G, US); *960* (G); Aragua: Colonia Tovar, *Fendler 1534* (G, NY, Mo); Maracay, *Vogl 1049* (Mun); Carabobo: Puerto Cabello, *André 161 in part* (G, NY, FM); Zulia: Lagunillas, *Jahn 961* (G); Maracaibo to Machiques, *Pittier 10544* (G). COLOMBIA: Magdalena: Tenerife, *André 161 in part* (G, NY, FM); Norte de Santander: Toledo, *Killip & Smith 20122* (G, NY, FM, S); Santander: Bucaramanga, *Killip & Smith 16391* (G, NY, FM, BM); Antioquia: Medellin, *Archer 384* (G, US); *Toro 79* (NY); Cundinamarca: Fusagasuga, *André 161 in part* (FM); Quetamé, *hb. nac. Colombia* (G, US); La Esperanza, *Ariste Joseph B 85* (G); Pandi, *Pennell 2832* (G, NY); El Valle: Cali, *Lehmann 7767* (FM); La Paila, *Holton 154* (NY); Dagua, *Killip & Hazen 11081* (G, US, NY); Palmira, *Pennell & Killip 6172* (G, US, NY). ECUADOR: Imbabura: Rio Chota, *Lehmann 646* (BM); Otavalo, *Hitchcock 20838* (G, NY). PERU: Piura: Cerro Prieto, *Haught 215* (NY, BM, S); Huanuco and Junin: *Ruiz & Pavon* (BM); Lima: Chosica, *Macbride 2880* (G, FM); Matucana, *Macbride & Featherstone 457 in part* (G, FM, S); Obrajillo, *Mathews 650 in part* (G). BOLIVIA: El Beni: Trinidad, alt. 250 m., 1926, *Werdermann 2530* (S); La Paz: Sorata, *Mandon 1177* (G, NY, S); *R. S. Williams 2424* (NY, BM); Apolo, *R. S. Williams 1485* (NY, US, BM); Illimani, *Buchtien 4143* (NY); Santa Cruz: Santa Cruz, *Steinbach 7452* (BM, FM, S, Mo). BRAZIL: Pernambuco: Recife, *Pickel 14489* (SP); Alagoas: Paulo Affonso Falls, *Chase 7809* (US); Minas Geraes: Lagoa Santa, *Warming* (Ko, type of var. *minuta;* phot. G); *Hoehne 6418, 6419* (MN Rio); Sabara, *Hoehne 6891, 6892* (MN Rio); Paraisopolis, *Hoehne 19181* (SP); Rio de Janeiro: Barra do Pirahy, *Hoehne & Gehrt 17329* (G, SP); São Paulo: Pirajussára, *A. Gehrt 12379* (G, SP); Campinas, *Mosén 375* (S); *G. Gehrt 3532* (G, SP); Itapira, *Hoehne 20400* (G, SP); Serra Negra, *Hoehne 20707* (G, SP); Atibaia, *Lindberg 563* (S); São Paulo, *Löfgren 12380* (G, SP); Serra de Caracol, *Mosén 1736; 1737; 4441* (S); Paraná: Villa Velha, *Dusén 2763* (MN Rio); Porto Amazonas, *Dusén 9530* (NY); Rio Grande do Sul: Porto Alegre, *Lindman A 255; A 1631a* (S); Piratinhý, *Lindman A 915* (S); Colonia Santo Angelo, *Lindman A 915b* (S); Santa Maria, *Lindman A 1631b* (S). PARAGUAY: Asuncion, *Balansa 618a* (Bo); *Lindman A 1855* (S); Ypacaray, *Hassler 1772* (NY); *Fiebrig 50* (G, FM, BM); Villa Rica, *Jörgensen 3964* (NY, FM, S, DH, Mo); *Lindman A 1777* (S); Pirapó, *Lindman A 1779* (S); San Antonio, *Lindman A 1783; A 1785* (S); central Paraguay, *Morong 492a* (G, NY, Mo, BM); San Bernardino, *Osten 8152b* (G, Ost); *8152* (Ost, S); *8922a* (Ost); Villa Encarnacion, *Rojas* (G, Ost); Carapeguá, *Rojas 203* (G, Ost); Rio Pilcomayo, El Chaco, *Lindman A 1895 1/2* (S); *Morong 292b; 876; 1085* (NY). URUGUAY: Artigas: Arapey, *Osten 3291* (Ost); Salto: *Schroeder* (Ost); Cerro Largo: Palleros, *Herter* (Ost, S); Soriano: Mercedes, *Osten 2943; 3054; 3120* (Ost); Treinta y Tres: Yerbal, *Herter 83393* (G); Minas: Arequita, *Herter 88899* (G, Mo). ARGENTINA: Formosa: *Jörgensen 3395* (G, Mo, US); Jujuy: Laguna de la Brea, *Fries 414* (G, S); Salta: San Carlos, *Venturi 7292* (US); *7293* (G, US); Tucuman: Naranjal, *Schreiter 749* (Ost); Yerba Buena, *Schreiter 27/2363* (G); *Venturi 268* (G, S, Ost); El Duraznito, *Venturi 2797* (G, US, FM, S); *2798* (G, S, Ost); Santa Fe: Sante Fe, *Castellanos 24/1218* (G); Buenos Aires: Buenos Aires, *Gillies* (K, type of *T. monostachys;* BM, G); *Tweedie* (BM); San Fernando, *Pennington* (G, SP). CHILE: *Cuming* (Mez!).

The typification of *Tillandsia recurvata* is quite simple, since Linnaeus had no material of his own when he originally published it as *Renealmia recurvata*, and gave but two references. These are based on the same plant since the Royen reference is nothing but a repetition of the Sloane one.

It has not been possible to check the record of this species from Chile and there is some doubt if it actually occurs there.

T. recurvata shows considerable variation from the West Indian form which is taxonomically typical to the form in the extreme southern part of its range. This southern form is smaller and more slender in habit, and has lepidote sepals which often exceed the bracts. Usually it is 1-flowered. Although the difference between the extremes is striking, the intergradations are manifold and it seems impossible to define any satisfactory categories within the species.

Mez has cited *Tillandsia Bartramii* Ell. under the synonymy of both *T. recurvata* and *T. tenuifolia*. The type of *T. Bartramii* in the Charleston Museum is obviously identical with *T. tenuifolia* and its supposed relation to *T. recurvata* must be the result of misinterpretation.

Venturi 2801 from El Duraznito, Tucuman, Argentina, is evidently a hybrid of *T. recurvata* and *T. bandensis* both of which occur in the same locality. The specimens of that number show various degrees of variation between the two species in the density of the inflorescence and its amount of indument.

39. **Tillandsia** (§ **Diaphoranthema**) **capillaris** R. & P. Plant very variable in both size and form, up to 16 cm. long when in flower: roots present: stems many from a single point, densely massed, simple or branched: leaves distichous, mostly 1–4 cm. long, rarely shorter or up to 9 cm. long, densely and finely pruinose-lepidote with cinereous to ferrugineous scales; blades erect to spreading, straight or rarely contorted, linear and less than 2 mm. thick or narrowly triangular and thicker according to the form represented; sheaths usually elliptic, thin, several-nerved, densely lepidote except where covered by the next below: scape from almost none to 8 cm. long, mostly slender, always naked, glabrous or slightly lepidote toward apex, developed almost wholly after anthesis: inflorescence normally 1-flowered, rarely 2-flowered; floral bracts ovate, acute or apiculate, thin with 3 or more strong nerves, densely lepidote to glabrous, usually equaling or exceeding the sepals: flowers subsessile; sepals lanceolate, acute or obtuse, up to 8 mm. long, connate posteriorly; petals narrow with blade scarcely distinct, white, yellow or brown; stamens deeply included, exceeding the pistil.—Saxicolous and epiphytic; Peru and Bolivia to central Argentina and Chile.—R. & P. Fl. Peruv. iii. 42, t. 271, fig. c (1802); Spreng. Syst. ii. 23 (1825); R. & S. Syst. vii. 1201 (1830); Wittm. in Engl. & Prantl, Nat. Pflanzenf. ii. Abt. 4, 56 (1888); Bak. Journ. Bot. xvi. 238 (1878); xxv. 213

(1887); Brom. 161 (1889); Mez in DC. Mon. Phan. ix. 878 (1896); Harms in Engl. & Prantl, Nat. Pflanzenf. ed. 2, xv a. 122 (1930). *Diaphoranthema capillaris* Beer, Brom. 153 (1857). *Tillandsia lanuginosa* Gill. ex Bak. in Journ. Bot. xvi. 237 (1878), in synon. *T. capillaris* var. β. *lanuginosa* Mez in DC. Mon. ix. 879 (1896).—Huachuacsso, Huayhuaço (Peru).

This very variable species has a number of forms whose extremes are easily differentiated, but which show all degrees of intergradation in any large collection. All doubtful cases are kept under the typical form in this treatment. The following key defines the principal forms:

1. Floral bracts with at least 5 strong nerves meeting near the apex.
   2. Scapes evident after anthesis and mostly exceeding the leaves.
      3. Floral bracts glabrous or scantly and deciduously lepidote: scapes conspicuously pseudo-axillary.
         4. Leaves slender and elongate, not over 2 mm. thick, obtuse, loose and spreading .... a. Forma *typica*
         4. Leaves short and stout, mucronate, appressed and ascending so that they form an almost continuous plane . b. Forma *incana.*
      3. Floral bracts densely and persistently lepidote: scapes usually but not invariably terminal: leaves widely spaced so that the greater part of each sheath is uncovered. . c. Forma *cordobensis.*
   2. Scapes never elongating much even after anthesis, mostly shorter than the leaves .... d. Forma *virescens.*
1. Floral bracts with only 3 strong nerves meeting near the apex, other nerves if any short and with free apices ...... e. Forma *Hieronymi.*

a. Forma **typica**, forma nov. foliis angustis elongatisque: scapis elongatis, pseudo-axillaribus: bracteis florigeris 5- vel pluri-nervatis, glabris vel subglabris.

PERU: *Ruiz & Pavon* (BM, TYPE; phot. G); *Dombey 162 in part* (Mez!); Huanuco: Huanuco, alt. 2300 m., 1922, *Macbride & Featherstone 2035* (G, FM, US, BM); Lima: Matucana, alt. 2700 m., 1922, *Macbride & Featherstone 457 in part* (G, FM); 1914, *Rose 18661* (G, US, NY); Junin: Tarma, *Mathews 650 in part* (K); Oroya, 1919, *Kalenborn 177* (G, US); Tarma, alt. 3000–3200 m., 1929, *Killip & Smith 21785; 21940* (US, G, NY); Cuzco: Ollantaitambo, alt. 2900–3100 m., 1915, *Cook & Gilbert 550* (US); 1925, *Pennell 13659* (G, FM); Mollepata, valley of the Apurimac, alt. 2750 m., *F. L. Herrera 1206* (Herrera!); Cuzco, 1914, *Rose 19033* (US); Sicuani, alt. 3551 m., 1903, *Hicken 10* (S). BOLIVIA: La Paz: Omasuyos near Achacache, alt. 4000 m., 1858, *Mandon 1181* (BM); Cotaña to Illimani, alt. 2450 m., 1911, *Buchtien 4026* (G); Rio Abajo, Huaricana, La Paz, alt. 2700 m., 1910, *Buchtien 807* (FM); below Obraje, alt. 3300 m., *Buchtien 6383* (US); La Paz, 1918, *Buchtien 381 in part* (S); Cochabamba: Cochabamba, alt. 2700 m., 1909, *Buchtien 2416* (US, NY); Santa Cruz: Santa Cruz, alt. 600 m., 1892, *Kuntze* (NY); Tarija: San Luis, 1864, *Pearce* (BM); Escayo, alt. 3600 m., 1904, *Fiebrig 3570* (BM); Tarija, alt. 2000 m., 1932, *Cardenas 211; 215* (G). ARGENTINA: Jujuy: dept. Ledesma, Sierra de Calilagua, alt. 700 m., 1927, *Venturi 7295* (US); Quinta near Laguna de la Brea, 1901, *Fries 418* (S); Tucuman: dept. Tafi, Naranjal, 1918, *Schreiter 796* (Ost); alt. 500 m., 1923, *Schreiter 3289* (Ost); dept. Trancas, Tapia, alt. 500 m., 1918, *Schreiter 804* (Ost); alt. 680 m., 1923, *Schreiter 3292* (Ost); dept. Trancas, Vipos, alt. 800 m., 1922, *Venturi*

1903 (G, US, Ost); alt. 780 m., 1923, *Schreiter 3290* (Ost); near la Hoyada, alt. 1000 m., 1920, *Venturi 1314* (US); Trancas, 1922, *Schreiter 27/2358* (G, BA); Sierra de la Candelaria, alt. 1000 m., 1924, *Venturi 3519* (US); Quebrada de Lules, 1922, *Schreiter 27/2359* (G, BA); Tucuman, alt. 400 m., 1922, *Venturi 1970* (G, BA, S, Ost); dept. Burroyaes, Alto de las Salinas, alt. 900 m., 1922, *Venturi 1971* (US); Córdoba: La Falda, Sierra Chica, alt. 1000 m., 1918, *Osten 10578; 13459* (Ost); *13462* (Ost, S); Mendoza: foot of the cordillera near Mendoza, 1823, *Gillies* (K, type of *T. lanuginosa;* phot. G).

b. Forma **incana** (Gill.), comb. nov. *Tillandsia incana* Gill. ex Bak. in Journ. Bot. xvi. 238 (1878), in synon. *T. propinqua* var. β. *saxicola* Hieron. Ic. & Descript. Argent. 16, t. 3, fig. 4 (1885), in part. *T. capillaris* γ. *incana* Mez in DC. Mon. Phan. ix. 879 (1896).

BOLIVIA: Potosi: prov. Nor Chichas, near Chorolque, alt. 3900 m., 1931, *Cardenas 91* (G); Potosi, alt. 4000 m., 1932, *Cardenas 209* (G). ARGENTINA: Tucuman: dept. Tafi, Sierra de San Javier, alt. 1100–1200 m., 1921, *Venturi 1515* (G, US); *1516* (G); Quebrada de la Hoyada, 1921, *Schreiter 27/2356* (G, BA); dept. Trancas, Vipos, alt. 800 m., 1922, *Venturi 1917* (G, S); alt. 786 m., 1923, *Schreiter 3288* (Ost); Catamarca: dept. Andalgalá, La Junta, 1917, *Jörgensen 1582* (G, US, Mo, BA); Córdoba: *Lossen 187* (G, FM, Mo, Bailey); Quebrada del Chorro, east of los Gigantes, Sierra Chica, 1878, *Hieronymus* (B, type of *T. propinqua* var. *saxicola*); Valle Hermoso, Sierra Chica, alt. 950 m., 1918, *Osten 13486* (FM, Ost); 1917, *Osten 10579* (Ost); near Capilla del Monte, Sierra Chica, alt. 1000 m., 1918, *Osten 13466* (Ost); *13476* (Ost, S); *13477* (Ost); 1922, *Castellanos 1575* (G, BA); near La Falda, Sierra Chica, 1918, *Osten 13488; 13489* (Ost); Rio Pintos, Sierra Chica, 1918, *Osten 13496* (Ost); Mendoza: foot of the Cordillera near Mendoza, *Gillies* (K, type; phot. G).

c. Forma **cordobensis** (Hieron.), comb. nov. *Tillandsia cordobensis* Hieron. Ic. & Descript. Argent. 10, t. 3, fig. 1 (1885); Mez in DC. Mon. Phan. ix. 875 (1896); O. Kuntze, Rev. Gen. iii. 303 (1898); Hicken, Chloris Platensis, 62 (1910); Hauman & Vanderveken, Phan. L'Arg. i., in An. Mus. Nac. Hist. Nat. B. A. xxix. 243 (1917); Harms in Engl. & Prantl, Nat. Pflanzenf. ed. 2, xv a. 122 (1930); Castellanos, Brom. Arg. iv., in An. Mus. Nac. Hist. Nat. B. A. xxxvii. 500 (1933). *T. recurvata* L. sensu Griseb. Pl. Lorentz. in Goett. Abh. xix. 225 (1874); Symb. Argent. in Goett. Abh. xxiv. 334 (1879), non L.

BOLIVIA: La Paz: near Sorata, alt. 2600 m., 1858, *Mandon 1177 in part* (NY); Ingenio del Oro, alt. 3300 m., 1886, *Rusby 2165* (G, FM). ARGENTINA: Chaco: Colonia Benitez, 1916, *Muello* (Castellanos!); Jujuy: 1892, *Kuntze* (NY); Cuyaya, 1922, *Inostrosa 2338* (Castellanos!); dept. Capital, Cerro de los Perales, 1903, *Holmberg* (Castellanos!); Salta: Rio de San Carlos, San Carlos, alt. 1000 m., 1927, *Venturi 7290* (G, US); Cerro de Cachi, San Carlos, alt. 2000 m., 1927, *Venturi 7294* (G); dept. Guachipas, Alemania, alt. 1400 m., 1929, *Venturi 9985* (G); Tucuman: Anfama, alt. 1800 m., 1906, *Monetti* (Ost); Tapia, 1920, *Schreiter 27/2347* (G, BA); dept. Famailla, Villa Nougues, alt. 1000 m., 1922, *Venturi 1900* (G, US); 1927, *Venturi 5476* (G); Catamarca: Andalgalá, 1917, *Jörgensen 1581* (G, US, Mo, Ost); La Rioja: Yerba Buena, Cerro Famatina, 1928, *Castellanos 28/104* (G, BA); Córdoba: *Lossen 191* (G, FM, Mo, Bailey); Sierra Achala, *Hieronymus 349* (B, type); Puerto Alegre, Sierra Achala, 1877, *Hieronymus* (US); Sierra Chica, Cuesta del

Pan de Azucar, 1887, *Hieronymus* (S); Los Gigantes, 1890, *Kurtz 6927* (NY); La Falda, Sierra Chica, alt. 1000 m., 1917, *Osten 10580a* (Ost); 1918, *Osten 13457* (Ost, S); *13487* (Ost); Valle Hermoso, Sierra Chica, alt. 1000 m., 1917, *Osten 10581* (Ost); Rio Pintos, Sierra Chica, alt. 1000 m., 1918, *Osten 13491* (Ost).

Grisebach and later authors have frequently confused this form with dwarf specimens of *T. recurvata*, because of the close habital resemblance. However, there need be no difficulty in distinguishing the two if it is kept in mind that *T. recurvata* always has two bracts beneath the lowest flower, the floral bract and a scape-bract, while *T. capillaris* has but the floral bract.

d. Forma **virescens** (R. & P.), comb. nov. *Tillandsia virescens* R. & P. Fl. Peruv. iii. 43, t. 270, fig. b (1802); Spreng. Syst. ii. 23 (1825); R. & S. Syst. vii. 1200 (1830); Bak. Brom. 161 (1889); Mez in DC. Mon. Phan. ix. 879 (1896); Reiche, Pflanzenverbreit. Chile in Engl. & Drude, Veg. d. Erde, viii. 164 (1907); Hauman & Vanderveken, Phan. L'Arg. i., in An. Mus. Nac. Hist. Nat. B. A. xxix. 248 (1917); Harms in Engl. & Prantl, Nat. Pflanzenf. ed. 2, xv a. 122 (1930); Reiche & Looser, Geog. Bot. Chile, 257 (1934). *T. propinqua* Gay, Fl. Chil. vi. 15 (1853); E. Morr. in Belg. Hort. xxiii. 234 (1873); Phil. in An. Univ. Chile, lix. 323 (1881); Cat. Pl. Chil. 279 (1881); Bak. Journ. Bot. xvi. 237 (1878); xxv. 213 (1887); Brom. 160 (1889). *Diaphoranthema virescens* Beer, Brom. 154 (1857). *Tillandsia pusilla* Gill. ex Bak. in Journ. Bot. xvi. 237 (1878); xxv. 213 (1887); Brom. 160 (1889); Mez in DC. Mon. Phan. ix. 877 (1896); Harms in Engl. & Prantl, Nat. Pflanzenf. ed. 2, xv a. 122 (1930); Castellanos, Brom. Arg. iv., in An. Mus. Nac. Hist. Nat. B. A. xxxvii. 506 (1933). *T. lichenoides* Hieron. Ic. & Descript. Argent. 17 (1885). *T. Stolpi* Phil. in An. Univ. Chile, xci. 614 (1895). *T. Williamsii* Rusby, Bull. N. Y. Bot. Gard. vi. 489 (1910). *T. dependens* var. *Sanzini* Hicken in Physis, i. 388 (1914); Hauman & Vanderveken, Phan. L'Arg. i., in An. Mus. Nac. Hist. Nat. B. A. xxix. 244 (1917).

PERU: Huanuco: *Ruiz & Pavon* (type; Madrid (?), not yet discovered in any herbarium); Lima: Rio Blanco, alt. 3000–3500 m., 1929, *Killip & Smith 21640* (G, NY); Junin: Casacancha to Culnai, *Wilkes Expedition* (G, US); Tarma to Oroya, alt. 2700 m., 1903, *Weberbauer 2555* (S); Oroya, 1924, *F. L. Stevens 14* (US); Cuzco: near Cuzco, alt. 3300–3500 m., 1922, *F. L. Herrera 47* (Herrera!); alt. 3500 m., 1924, *F. L. Herrera 821* (US); 1916, *C. Watkins* (US); Arequipa: near Arequipa, alt. 2500 m., 1901, *R. S. Williams 2530* (NY, US, BM); Yura, alt. 2800 m., 1901, *R. S. Williams 2539* (NY, type of *T. Williamsii*); Puno: near Puno, alt. 3125 m., 1919, *Mrs. R. S. Shepard 48* (G); Indefinite: *Dombey 162 in part; C. Gay 546; Meyen; Stuebel* (Mez!). BOLIVIA: La Paz: near La Paz, alt. 3300 m., 1885, *Rusby 2164* (NY, FM, US); 1889, *Bang 123* (G, US, NY, Mo, BM); 3650–3800 m., 1906, *Buchtien 155 in part* (US); *805 in part* (S); 1910, *Buchtien* (Ost); *Buchtien 805 in part* (US, NY); *2556* (NY); 1911, *Buchtien* (NY); 1913, *Buchtien* (G, FM); 1918, *Buch-*

tien 107 (G); *381* (Mo, Pom, BM, S); 1930, *Jaffuel 585* (G); Ullama to Challapa, alt. 4000 m., 1921, *Asplund 6382* (US); Cochabamba: Cochabamba, alt. 3000 m., 1892, *Kuntze* (NY); Oruro: Pazña, alt. 4200 m., 1908, *Buchtien 1271* (US). ARGENTINA: Jujuy: La Rinconada, alt. 3800 m., 1901, *Claren 11343* (S); Tilcara, alt. 3400 m., 1927, *Venturi 7638* (G); Moreno, alt. 3500 m., 1901, *Fries 682a* (S); Abra de Tactul, alt. 4000 m., 1901, *Fries 689* (S); Los Andes: Susques, 1927, *Castellanos 27/773* (G, BA); Salta: Guachipas, 1873, *Lorentz & Hieronymus 1180* (S, B, type of *T. lichenoides*; phot. G); dept. Candelaria, Sierra de la Candelaria, alt. 1100 m., 1924, *Venturi 8666* (US); dept. San Carlos, Cerro de Cachi, alt. 2500 m., 1927, *Venturi 7302* (US); same, alt. 3000 m., *Venturi 7296* (US); Tucuman: 1933, *Burkart 5376* (G, SP); dept. Tafi, Peñas Azules, alt. 3800 m., 1933, *Parodi 10889* (G); Valle de Tafi, alt. 2000 m., 1918 and 1923, *Schreiter 805; 3287* (Ost); La Rioja: Cerro Famatina, Cienaga de Cosme, 1928, *Castellanos 28/101* (G, BA); Cerro Famatina, Guanchin, 1928, *Castellanos 28/103* (G, BA); Mendoza: *Gillies* (K, type of *T. pusilla*; phot. G); 1921, *Hosseus* (S); dept. Las Heras, alt. 2800 m., 1913, *Sanzin 56* (Ost, phot. G); 1916, *Sanzin 25/1868* (G, BA); Precord San Ignacio, alt. 1300 m., 1915, *Sanzin 567* (Ost). CHILE: Coquimbo: *Gay* (P, type of *T. propinqua*; phot. G); near Illapel, 1914, *Rose 19256* (US, NY); Aconcagua: Llayllay, 1832, *Bridges 534* (K, phot. G; BM); O'Higgins: dept. Victoria, Naltagua, 1888, *Stolp* (Chile, type of *T. Stolpi*; phot. G); Indefinite: *Cuming 167* (BM, K, phot. G); *Philippi 968* (P).

Sanzin 56, cited above, is probably the type collection of *T. dependens* var. *Sanzini*, but unfortunately there is no number cited in the type description.

e. Forma **Hieronymi** (Mez), comb. nov. *Tillandsia Hieronymi* Mez in DC. Mon. Phan. ix. 876 (1896); Kuntze, Rev. Gen. iii. 304 (1898); Hauman & Vanderveken, Phan. L'Arg. i., in An. Mus. Nac. Hist. Nat. B. A. xxix. 244 (1917); Castellanos, Brom. Arg. iv., in An. Mus. Nac. Hist. Nat. B. A. xxxvii. 503 (1933). *T. propinqua* Gay sensu Griseb. Symb. Argent. in Goett. Abh. xxiv. 334 (1879); Hieron. Ic. & Descript. Argent. t. 3, figs. 2–3 (1885); Bak. Brom. 160 (1889), in part. non Gay. *T. dependens* Hieron. ex Mez in DC. Mon. ix. 880 (1896); Hauman & Vanderveken, Phan. L'Arg. i., in An. Mus. Nac. Hist. Nat. B. A. xxix. 244 (1917); Harms in Engl. & Prantl, Nat. Pflanzenf. ed. 2, xv a. 122 (1930). Vars. *perusneoides* and *percordobensis* Mez, ibid. 881; Hauman & Vanderveken, ibid. Formae *perusneoides* and *percordobensis* Castellanos, Brom. Arg. iv., in An. Mus. Nac. Hist. Nat. B. A. xxxvii. 500 (1933).

BOLIVIA: La Paz: Palca to Illimani, alt. 3600–4300 m., 1906, *Hauthal* (S); Tarija: Tarija, alt. 2000 m., 1932, *Cardenas 212* (G). ARGENTINA: Jujuy: Quinta, near Laguna de la Brea, 1901, *Fries 34* (S); dept. San Pedro, Sierra Santa Barbara, alt. 750 m., 1929, *Venturi 9743 a* (G); Salta: dept. Candelaria, Sierra de la Candelaria, alt. 1000–1150 m., 1924, *Venturi 4079; 8668* (US); Tucuman: dept. Leales, Chañar Pozo, alt. 300 m., 1919, *Venturi 736* (G); Vipos, 1922, *Venturi 1228* (G, BA); dept. Trancas, Tapia, alt. 750 m., 1921, *Venturi 1364* (US); Catamarca: dept. Santa Maria, Portezuelo to Las Animas, alt. 3000 m., 1925, *Venturi 6890* (US); La Rioja: Cerro Famatina, Cienaga de Cosme, 1928 *Castellanos 28/102* (G, BA); Sierra Famatina, Guanchin, 1928, *Castellanos 28/105* (G, BA); CÓRDOBA: 1891, *Kuntze* (NY); *Hieronymus 124* (B, TYPE; FM, US, phot. G); *422* (Mez!); *870* (B); *Hieronymus & Niederlein; Kurtz 4398; 6667; Lorentz 124; 126 in part; 127 in part; 868; Lorentz & Hieronymus 527* (Mez!); *Kurtz 6597* (NY); Cuesta del Pan de Azucar, Sierra Chica, 1881, *Hieronymus* (NY); Sierra de Córdoba, *Hieronymus 352* (B, type of *T. dependens* var. *percordobensis;* phot. G); 1876, *422* (S); Cerro Champagni, near Rio Cobre, Sierra Achala, 1877, *Hieronymus 781* (B, type of *T. dependens* var. *perusneoides;* FM, US, phot. G); Dean Funes, 1916, *Sanzin 1159* (Ost); La Falda, Sierra Chica, alt. 1000 m., 1917–8, *Osten 10580-b* (Ost); *13460* (Ost, S); *13461* (Ost); Los Paredones near Capilla del Monte, Sierra Chica, alt. 1000 m., 1918, *Osten 13475* (Ost); Huerta Grande, Sierra Chica, alt. 1000 m., 1918, *Osten 13482* (Ost); Valle Hermoso, Sierra Chica, alt. 950 m., 1918, *Osten 13483; 13485* (Ost); Cajon de Rio Primero near San Antonio, Sierra Chica, alt. 900 m., 1918, *Osten 13490* (Ost); SAN LUIS: Quebrada del Salado, near Bebida de las Vacas, 1882, *Galander* (S); Villa Mercedes, 1926, *Castellanos 25/2779* (G, BA); Merlo to Rincon, 1929, *Tepes 29/67* (G, BA).

It seems doubtful if the material which Mez described under *T. dependens* is really a hybrid with *T. usneoides* as he thought. To be sure the stem and leaves are somewhat more elongate than in other specimens of *T. capillaris*, but there is no tendency toward alternation of long and short internodes on the stem and consequent exposing of portions of the internodes such as one might expect in any hybrid involving *T. usneoides.*

40. **Tillandsia** (§ **Diaphoranthema**) **usneoides** L. Plant growing pendent from trees in branching strands up to 8 m. long: roots absent: stem sympodial, less than 1 mm. in diameter, internodes 3–6 cm. long with only the extreme base covered by the leaf-sheath, strongly curved, pseudo-axillary branches really a continuation of the main axis, very short and concealed by the basal leaf-sheath, bearing 2–3 leaves: leaves distichous, 25–50 mm. long, densely cinereous- or ferrugineous-lepidote; sheaths elliptic, involute, up to 8 mm. long; blades filiform, less than 1 mm. in diameter: scape practically none: inflorescence reduced to a single pseudo-terminal flower; floral bract ovate, apiculate or caudate, densely lepidote, shorter than the sepals: flower subsessile; sepals narrowly ovate, acute, up to 7 mm. long, thin, strongly nerved, glabrous, equally short-connate; petals narrow, acute or obtuse, 9–11 mm. long, pale green or blue; stamens deeply included, exceeding the pistil: capsule up to 25 mm. long, cylindric, abruptly short-beaked.—Always epiphytic; southeastern United States to central Argentina and Chile, but apparently very rare or absent in the Amazon Basin.—Sp. Pl. ed. 2. 411 (1762); Lam. Encycl. i. 619 (1785); Willd. Spec. ii. 15 (1799); R. & P. Fl. Peruv. iii. 43 (1802); Michx. Fl. Bor.-Am. i. 195 (1803); Poir. Encycl. vii. 672 (1806); Pursh, Fl. Sept.-Am. i. 217 (1814); Meyer, Fl. Esseq.

146 (1818); Nutt. Gen. i. 208 (1818); Ell. Bot. S. Car. & Ga. i. 379 (1821); LeC. in Ann. Lyc. Nat. Hist. N. Y. ii. 132 (1828); R. & S. Syst. vii. 1199 (1830); Gray, Man. ed. 2, 458 (1856); Beer, Brom. 151 (1857); E. Morr. in Belg. Hort. xxvii. 313, t. 17 (1877); Hook. f. in Bot. Mag. ciii. t. 6309 (1877); F. von Hoehnel in Dingler's Polytechn. Journ. n. 234. 407 (1879); Benth. & Hook. Gen. iii. 669 (1883); Hemsl. Biol. Centr.-Am. iii. 322 (1884); Wittm. in Engl. & Prantl, Nat. Pflanzenfam. ii. Abt. 4, 56, t. 27 (1888); Bak. Journ. Bot. xxv. 212 (1887); Brom. 159 (1889); Mez in Mart. Fl. Bras. iii. pt. 3, 613 (1894); Mez in DC. Mon. Phan. ix. 881 (1896); Britton & Brown, Ill. Fl. i. 374, t. 904 (1896); J. Huber, Bolet. Mus. Para. iii. 328 (1902); F. H. Billings, Bot. Gaz. xxxviii. 99 (1904); Pulle, Pl. Surinam, 92 (1906); Boldingh, Fl. Ned. W.-I. 144 (1913); Hassler, Cons. & Jard. Bot. Genève, xx. 336 (1919); J. Weese in Wiesner, Rohstoffe, n. 4. 649 (1927); Harms in Engl. & Prantl, Nat. Pflanzenfam. ed. 2, xv a. 122 (1930); Herter, Fl. Urug. 45 (1930); Standl. Field Mus. Pub. Bot. iii. 222 (1930); x. 129 (1931). *Camanbaya* Marcgrav. Bras. 46 (1658); Petiv. Gaz. t. 62, fig. 12 (1709). *Cuscuta, ramis arborum innascens Caroliniana, filamentis lanugine tectis* Pluken. Alm. 126 (1696) and Phytogr. t. 26, fig. 5 (1691); Moris. Hist. Oxon. iii. 615 (1715). *C. lendiginosa tenuissime cirrhis* Pluken. Alm. 126 (1696) and Phytogr. t. 26, fig. 6 (1691). *C. americana super arbores se dissidens* Ray, Hist. Pl. ii. 1904 (1693). *Viscum Caryophylloides tenuissimum, e ramulis arborum musci in modum dependens, foliis pruinae instar candicantibus, flore tripetalo, semine filamentoso* Sloane, Cat. 77 (1696); Ray Hist. Pl. Suppl. 406 (1704); Sloane, Hist. i. 191, t. 122, figs. 2–3 (1707). *Renealmia filiformis intorta* L. Hort. Cliff. 129 (1737); Gron. Virg. 36 (1739); Royen, Lugd.-Bat. 25 (1740); Barrère, Aequin. 99 (1741). *Fucus filum* Esper, Fuc. t. 20 (1800). *Rhizomorpha ochreata* Achar. Syn. 391 (1814). *Renealmia usneoides* L. Sp. Pl. 287 (1753). *Tillandsia trichoides* HBK. Nov. Gen. i. 290 (1816); R. & S. Syst. vii. 1200 (1830); Beer, Brom. 153 (1857). *T. filiformis* Lodd. Catal. ex R. & S. Syst. vii. 1229 (1830). ? *T. pendula* Hort. Lovan. ex R. & S. Syst. ibid. *Dendropogon usneoides* Raf. Fl. Tellur. iv. 25 (1838); Small, Fl. s. e. U. S. 245 (1903); Britton & Brown, Ill. Fl. ed. 2, i. 456, t. 1146 (1913); Britton & Wilson, Bot. P. Rico, v. 138 (1923). *Strepsia usneoides* Steud. Nomencl. ed. 2, ii. 645 (1841). *Tillandsia crinita* Willd. ex Beer, Brom. 152 (1857). *T. usneoides* formae *genuina, longissima, filiformis, major, ferruginea, crispa* André, Brom. Andr. 64 (1889). Forma *cretacea* Mez in Mart. Fl. Bras. iii. pt. 3, 615 (1894). Forma *robusta* E. Morr. ex Mez, ibid. Var. β. *filiformis* Mez

in DC. Mon. Phan. ix. 883 (1896); var. γ. *ferruginea* Mez, ibid; Castellanos, Physis, x. 89 (1930); var. б. *longissima* Mez in DC. Mon. Phan. ix. 883 (1896); var. ε. *robusta* Mez, ibid.; var. ζ. *cretacea* Mez, ibid.—SPANISH MOSS; LONG MOSS; BLACK MOSS; OLD MAN'S BEARD; BARBA ESPAÑOLA (Central America); PASHTE (Honduras); MEXNUXIB; MEEXNUXIB; SOSCILCHAC (Yucatan); GUATACA (Cuba); BARBA DE UCAR (Porto Rico); BARBA DO VELHO; BARBA DE PÁO; BARBA DEL MONTE (Brazil); BARBA DE MONTE; BARBA DE TALA; BARBA DE PALO; BARBA DE VIEJO (Uruguay); BARBON (Chile); CRIN VÉGÉTAL (French); BAUMHAAR; HANGENDES MOOS (German).

UNITED STATES: VIRGINIA: Northampton Co.: Eastville, *Canby* (Mo); Princess Anne Co.: Virginia Beach, *N. L. Britton* (NY); *Vail* (NY); Knott's Is., *Harper 10* (NY, FM); Norfolk Co.: Dismal Swamp, Lake Drummond, *Leonard & Killip 412* (FM); Norfolk, *Durand* (G); *E. G. Britton* (NY); NORTH CAROLINA: Beaufort Co.: Leechville, *Wiegand & Manning 724* (G); Craven Co.: Lake Ellis, *Brown 110* (US); Havelock, *Fogg 5525* (G); Bladen Co.: *Ashe 2388* (NY); Elizabethtown, *Heller 14081* (FM); New Hanover Co.: Wrightsville, *Biltmore hb. 4701 a* (G, NY, Mo, BM); Forsyth Co.: Winston-Salem, *Schallert* (NY); Iredell Co.: Statesville, *Hyams* (Pom); SOUTH CAROLINA: Williamsburg Co.: Kingstree, *Wiegand & Manning 725* (G); Georgetown Co.: Santee Canal, *Ravenel* (S); Dorchester Co.: Summerville, *Taylor* (G); Charleston Co.: Edisto Is., *Murray 1299* (NY); Beaufort Co.: Bluffton, *Mellichamp* (US, Mo); GEORGIA: Richmond Co.: Augusta, *Olney & Metcalf 98* (G); McIntosh Co.: Darien, *Gilbert* (NY); *H. H. Smith 2140* (FM); Glynn Co.: Brunswick, *Chapman 472* (G); Charlton Co.: St. Marys River, *Small* (NY, FM); Sumter Co.: Flint River, *Harper 1048* (G, NY, Mo, BM); Dougherty Co.: Albany, *Gillespie 10000* (Bailey); Thomas Co.: Thomasville, *Clarke* (NY); FLORIDA: Duval Co.: *Fredholm 103* (Pom); *5231* (G); Jacksonville, *Churchill* (G); *Curtiss 2850* (G, NY, BM); *4142* (NY); *4673* (G, NY); *Keeler* (NY); St. Nicholas, *Lighthipe 58* (NY); Alachua Co.: Gainesville, *Garber* (G); *Knight 7883* (NY); Volusia Co.: New Smyrna, *Deam 1605* (NY); Enterprise, *Faxon* (G); Ormond, *Gilbert* (G); Lake Co.: Eustis, *Nash 464* (G, NY); *1932* (NY); Orange Co.: Winter Park, *Ensminger* (G); *Lewton* (NY); Brevard Co.: Cape Canaveral, *Burgess 689* (NY); Pinellas Co.: Tarpon Springs, *Wilson* (NY); Hillsborough Co.: Tampa, *Merrill* (NY); Palm Beach Co.: Juno, *Randolph & Small 61* (G); Lee Co.: Ft. Myers, *Hitchcock 348* (G, NY); *Standley 157* (G, NY); Dade Co.: Miami, *Moldenke 538* (NY, S); Elliott's Key, *Small & Nash* (NY); Cutler, *Small & Carter* (NY); Miami R., *Small 4537* (NY); Leon Co.: Tallahassee, *Rugel 380* (NY, BM); ALABAMA: Elmore Co.: Tallassee, *Harper 80* (G, NY, Mo, Bailey); Montgomery Co.: Montgomery, *McCarthy* (G); Mobile Co.: Mobile, *Dewey* (G); *Graves 863* (Mo); MISSISSIPPI: Hinds Co.: Clinton, *Smart* (G); Adams Co.: Natchez, *Shimek* (FM, Mo); Jackson Co.: Ocean Springs, *Pollard 1080* (G, NY, FM, Mo, Pom); Harrison Co.: Biloxi, *Baker* (NY); *Tracy* (NY, FM, BM); Hancock Co.: Bay St. Louis, *Munz 1369* (Pom); LOUISIANA: St. Tammany Co.: Mandeville, *Pennell 4202* (NY); Plaquemines Co.: Myrtle Grove, *Benke 5523* (G, FM); Rapides Co.: Alexandria, *Ball 504* (G, NY, FM, Mo, BM); St. Landry Co.: Melville, *Bush 251* (NY); East Baton Rouge Co.: *Joor* (FM); St. Martin Co.: St. Martinville, *Langlois* (Bailey); Orleans Co.: New Orleans, *Benke 3182* (FM); TEXAS: Walker Co.: *Dixon 607* (FM, Pom); Dido, *Dixon 185* (FM); Huntsville, *Bailey* (Bailey); Montgomery Co.: Willis, *Dixon 282* (FM); Harris Co.: Houston, *Kuntze 23819* (NY); Brazos Co.: College Station, *Kellogg* (Mo);

Travis Co.: Austin, *Underwood* (NY); Hays Co.: San Marcos, *Trelease* (Mo); Comal Co.: New Braunfels, *Lindheimer 1202; 1203* (G, NY, FM, Mo, BM); Kendall Co.: *Reverchon 4036* (G, NY, Mo); Bexar Co.: San Antonio, *Bell* (NY); *Clemens 145* (Mo, Pom, Bailey); *Jermy 198* (G); Brazoria Co.: Columbia, *Bush 211* (NY, Mo); Brazoria, *Stewart* (G); Maverick Co.: Eagle Pass, *Plank* (NY); Nueces Co.: Corpus Christi, *Ravenel 171* (NY); Cameron Co.: Brownsville, *Ferris & Duncan 3176* (NY, Mo, Bailey). MEXICO: TAMAULIPAS: Tampico, *Lachen 96* (BM); *Palmer 183* (G, NY, FM, Mo, BM); *Mercier* (S); Gómez Fárias, *Palmer 359* (G, NY, Mo, FM); Jaumave to Victoria, *Rozynski 252* (FM); NUEVO LEON: near Pueblo Galeana, *Mueller 326* (G); BAJA CALIFORNIA: *Palmer* (Mo); SINALOA: Mazatlan, *Lamb 378* (NY, Bo); *379* (G, DH); *Ortega 6841* (FM); DURANGO: Durango, *Palmer 124* (G, NY, FM, Mo, UCal, BM, Bo, S); SAN LUIS POTOSI: Los Canos, *Palmer 229* (G, NY, FM, Mo); VERA CRUZ: Maltrata, *Kerber 262* (BM); Vera Cruz, *Houston* (Cam); Orizaba, *Mueller 347* (NY); NAYARIT: Pedro Paulo, *Rose 2004* (G); MICHOACAN: Chapultepec, *Berlandier 46 a* (BM); *Brandegee* (UCal); *Gregg* (G, Mo); *Bourgeau 95* (G, S); MEXICO: Amecameca, *Fröderström & Hultén 1206* (S); Valley of Mexico, *Schmitz* (BM); *Schaffner* (BM); FEDERAL DISTRICT: Mexico City, *Tenfer* (NY); TLAXCALA: Santa Ana, *Arsène 7* (Mo); PUEBLA: San Luis Tultitlanapa, *Purpus 3395* (G, NY, FM, Mo, BM, S); Cerra de Pinas, *Russell & Souviron 238* (US); GUERRERO: Acapulco, *Palmer 537* (G, NY, FM, Mo); CHIAPAS: San Vicente, *Nelson 3504* (G); YUCATAN: Silam, *Gaumer 663* (G, NY, FM, BM, S). GUATEMALA: PETEN: Lake Yaxha, *Lundell 2210* (G); BAJA VERAPAZ: Sierra de las Minas, *Kellerman 6282* (FM); Santa Rosa, *Tuerckheim 325* (G); *II 2333* (NY); GUATEMALA: Guatemala, *Hayes* (G); SANTA ROSA: Santa Rosa, *Heyde & Lux 4633* (G). HONDURAS: ATLÁNTIDA: Tela, *Standley 56702* (FM); COMAYAGUA: Siguatepeque, *Standley 56070* (G, FM); OLANCHO: Salama, *Weaver 2* (NY). NICARAGUA: *Wright* (Mo). COSTA RICA: CARTAGO: Turrialba, *Pittier & Tonduz 8246* (Bo); *Polakowsky 498* (BM); Cartago, *Polakowsky 99* (BM). BAHAMAS: 1730, *Dale* (BM); New Providence Is., *Britton & Brace 238* (NY, FM); Cat Is., *Britton & Millspaugh 5965* (NY, FM); Inagua Is., *Nash & Taylor 1179* (NY, FM). CUBA: ISLA DE PINOS: Rio Nuevas, *Jennings 292* (BM); Sierra de Casas, *Ekman 12567* (S); McKinley, *Jennings 301* (NY); PINAR DEL RIO: Bañas San Vicente, *Britton & Gager 7380* (NY); Galafre, *Britton & Cowell 9831* (NY); Los Palacios, *Shafer 11817* (NY, Mo); Sumidero, *Shafer 13818* (NY, FM); Sierra de Anafe, *Wilson 11442* (NY); HAVANA: Loma Esperon, *Ekman 672* (S); Sierra de Anafe, *Ekman 1123* (G, Mo, S); Rincon, *Wilson 1059* (G, NY, FM); MATANZAS: Matanzas, *Britton & Shafer 238* (NY); SANTA CLARA: Cieneguita, *Combs 343* (G, NY, FM, Mo); CAMAGUEY: La Gloria, *Shafer 105* (NY, FM); Cayo Guajaba, *Shafer 723* (NY, FM); ORIENTE: *Wright* (G); Cabo Cruz, south of Niquero, *Ekman 16187* (S); Rio Rioja, *Ekman 4884* (Mo, FM, BM, S); Woodfred, *Ekman 15577* (G, S); Santiago, *Pollard & Palmer 275* (G, NY, FM, Mo); *Taylor 110* (NY); Farallon de La Perla, *Shafer 8778* (NY). JAMAICA: 1687–90, *Sloane* (BM, TYPE; phot. G); *Swartz* (S); Bridgehill, *Bot. Dept. Jamaica* (BM). HAITI: Anse Galette, Gonaive Is., *Leonard 3048* (NY); Gros Morne, dept. L'Artibonite, *Leonard 10018* (US); La Vallée, Tortue Is., *Leonard 15323* (US); Port Margot, *Nash 374* (NY); Marmelade, *Nash & Taylor 1239* (NY). SAN DOMINGO: Azua, *Rose, Fitch & Russell 3821* (NY); Constanza, *Tuerckheim 3062* (NY, BM); Moncion, Monte Cristi, *Valeur 262* (NY, FM, Mo, S); *788* (US). PORTO RICO: Coamo Springs, *Britton & Cowell 1330* (NY, FM); Ponce to Coamo, *Heller 513* (NY, FM); Mayaguez, *Hunn* (Bailey); Cabo Rojo, *Sintenis 569* (G, NY, S); Aguirre, *Underwood & Griggs 365* (NY). LESSER ANTILLES: ST. CROIX: *Ricksecker 267* (G, NY, FM, Mo); ST. MARTIN: *Boldingh 3416* (NY); GUADELOUPE: *Duss 3322* (NY); MARTINIQUE: *Duss 993* (NY);

Forsström (S); ST. VINCENT: *H. H. & G. W. Smith 1429* (NY); TRINIDAD: *Fendler 813* (BM); *R. Bot. Gard. Trin. 822* (Trin.); *Sieber 345* (Mo). SURINAM: Paramaribo *Samuels 45* (G, NY). BRITISH GUIANA: *Schomburgk 159* (BM); BERBICE: Canje Creek, *Bartlett* (Jenman). VENEZUELA: SUCRE: Cristobal Colon, *Broadway 50* (G, NY); MANAGAS: Caripe, *Humboldt & Bonpland 347* (B, P, type of *T. trichoides* and *T. crinita;* phot. G); DELTA AMACURO: Corisal, *Bond, Gillin & Brown 199* (G); DISTRITO FEDERAL: Caracas, *Bailey 574* (G, Bailey); ARAGUA: Colonia Tovar, *Fendler 1535* (G, NY, Mo, S); MERIDA: Tabay, *Gehriger 431* (NY, FM); Timotes, *Vogl 1043* (Mun). COLOMBIA: BOLIVAR: Cartagena, *Triana 534* (BM); NORTE DE SANTANDER: Toledo, *Killip & Smith 20121* (G, NY, FM); SANTANDER: Bucamaranga, *Killip & Smith 16348* (G, NY, FM, S); CUNDINAMARCA: Fusagasuga, *André 1860* (G, NY); Pandi, *Pennell 2836* (NY); EL VALLE: La Paila, *Holton 155* (NY). ECUADOR: *Spruce 5435* (G, BM); AZUAY: Cuenca, *Rose 22943* (G, NY); ORO: Machala, *Barclay 515* (BM); LOJA: El Tambo to La Toma, *Hitchcock 21325* (G, NY). PERU: *Ruiz & Pavon* (BM); PIURA: Cerro Prieto, *Haught F-124* (FM); HUANUCO: Huanuco, *Macbride & Featherstone 2378* (G, FM, S); LIMA: Matucana, *Rose 18671* (NY); CUZCO: Valle del Paucartambo, *Herrera 3378* (G, FM); Cuzco, *Herrera 820* (FM). BOLIVIA: LA PAZ: Sorata, *Mandon 1182* (G); La Paz, *Bang 107* (G, NY, FM, Mo, BM); *Buchtien 155 in part* (G); *599* (NY, FM, Mo, Pom, S); *Jaffuel 583* (G); Illimani, *Buchtien* (BM); CHUQUISACA: prov. Cinti, Huarinota, Quebrada Honda, alt. 3200 m., *Hammarlund 375* (S). BRAZIL: CEARÁ: *Allemão CLXXI in part* (MN Rio); *Allemão & Cysneiros 1524* (MN Rio); PERNAMBUCO: Jaqueira, *Ridley, Lea & Ramage* (BM); BAHIA: *Glocker 198* (S, BM); MINAS GERAES: Caldas, *Regnell III 1251* (S, FM, MN Rio); Lagoa Santa, *Hoehne 6353* (MN Rio); Turvo, *Hoehne & Gehrt 17574* (G, SP); RIO DE JANEIRO: Nictheroy, *Smith & Brade 2328* (G); FEDERAL DISTRICT: Rio de Janeiro, *Andersson* (S); *Forsett 93* (S); *Mosén 2622* (S); *Widgren* (S); SÃO PAULO: Moóca, *Brade 6310* (S); *6311* (G, S, SP); Butantan, *Hoehne 12* (G, SP); Santos, *Luederwalt & Fonseca 12383* (G, SP); Piracicaba, *Puttemans 12382* (G, SP); Piquete, *Robert* (BM); Ytú, *Russell 17975* (G, SP); Cubãtao, *Smith 2041* (G, S, FM); São Paulo, *Smith & Kuhlmann 1811* (G); PARANÁ: Restinga Secca, *Dusén 3130* (S, MN Rio); Serrinha, *Dusén 17673* (G, S, BM); Tibagy, *Reiss 16* (G); SANTA CATHARINA: *Macrae* (BM); RIO GRANDE DO SUL: Porto Alegre, *Lindman A 469* (S). PARAGUAY: *Jörgensen 4483* (Mo, DH, S); Pilcomayo River, *Morong 886* (NY, FM, Mo, BM). URUGUAY: ARTIGAS: Arapey, *Osten 3287* (Ost); CERRO LARGO: Palleros, *Herter* (Ost); TREINTA Y TRES: Tacuari, *Herter 94037* (G, Mo); RIO NEGRO: *André K 325* (G, NY, FM); SORIANO: Mercedes, *Osten 3121* (Ost). ARGENTINA: JUJUY: Sierra de Santa Barbara, 1901, *Fries 413* (S); TUCUMAN: La Cienaga, *Lorentz 798* (G, BM, SP); CÓRDOBA: *Lossen 428* (G, FM, Mo, Bailey); Sierra Grande, *Hieronymus* (FM); Sierra Achala, *Hieronymus* (NY); Los Gigantes, *Kurtz 6928* (NY); BUENOS AIRES: Barca Grande, Delta del Paraná, *Cabrera 1635* (G, SP). CHILE: ACONCAGUA: Quillota, *Bertero 1359* (G); Zapallar, *Behn* (FM); Valparaiso, *Dusén* (S); *King* (BM); Cerro Campana, *Looser 581* (G); Palos Quemados, *Looser 2760* (G); Quilpue, *Philippi & Borchers* (BM); BIOBIO: Santo Barbaro, *Reed* (BM); Rio Duqueco, *Reed* (G); CAUTIN: Temuco, *Claude-Joseph 1173* (US).

Considering its wide range, *T. usneoides* varies remarkably little and then without any discernible relation to its distribution. If the forms and varieties so far proposed are worth keeping then there is practically no limit to those that can and logically should be made. Consequently the species is considered here without any subdivision whatever.

Since no material of this species can be found in either the Linnean or Clayton collections, the type, like that of *T. recurvata,* must rest on Sloane's material.

Prof. Harms informs me that there is no specimen labelled *Tillandsia crinita* at Berlin-Dahlem, but that the specimen labelled *T. trichoides* in Willdenow's herbarium is the one that Beer described as *T. crinita.*

Explanation of Plates.

Plate I.

Fig. 1. Guzmania Hitchcockiana L. B. Smith (*Hitchcock 20436*), branch of inflorescence × ½.
2. Hechtia Meziana L. B. Smith (*Purpus 10276*), scape and lowest branch of inflorescence × ½.
3. Same, longitudinal section of flower × 2.
4. Hohenbergia inermis Mez (*Britton 1468*), petal and stamen × 5.
5. Hohenbergia caymanensis Britton (*Rothrock 495*), spike from near apex of inflorescence × ½.
6. Same, sepal × 3.
7. Hohenbergia negrilensis Britton (*Britton & Hollick 2023*), spike × ½.
8. Same, floral bract × 2.
9. Hohenbergia stellata Schult. f. (*Martius*), flower × 1.
10. Mezobromelia bicolor L. B. Smith (*Killip 11396*), inflorescence × ½.
11. Same, corolla × 2.
12. Canistrum perplexum L. B. Smith (*Hoehne 31550*), inflorescence × ½.
13. Same, expanded sepal × 1.
14. Same, petal and stamens × 2.
15. Same, diagrammatical cross-section of petal and filaments × 10.
16. Puya lasiopoda L. B. Smith (*Rusby 2232*), floral bract and flower × ½.
17. Same, expanded sepal × 1.
18. Pitcairnia kniphofioides L. B. Smith (*Lehmann 3310*), inflorescence × ½.

Plate II.

Fig. 1. Puya sanctae-crucis (Bak.) L. B. Smith (*Castelnau*), floral bract and flower × 1.
2. Tillandsia lepidosepala L. B. Smith (*Pringle 5323*), habit × ½.
3. Same, sepal × 1.
4. Tillandsia caulescens Brongn. (*Gay 1186*), habit × ¼.
5. Tillandsia argentina C. H. Wright (*Venturi 2494*), habit × ½.
6. Same (*Venturi 9978*), sepal × 1.
7. Same, petal and stamens × 2.
8. Tillandsia incarnata HBK. (*Humboldt & Bonpland*), habit × ¼.
9. Same (*Killip & Smith 19767*), posterior sepals × 1.
10. Same (*Rimbach 121*), petal and stamens × 2.
11. Tillandsia Friesii Mez (*Fries 828*), habit × ½.

Plate III.

Fig. 1. Tillandsia cauligera Mez (*Weberbauer 4050*), habit × ¼.
2. Tillandsia arhiza Mez (*Balansa 4746*), habit × ¼.
3. Same (*Balansa 4747*), inflorescence × ½.
4. Tillandsia Werdermannii Harms (*Werdermann 717*), inflorescence and upper part of scape × ½.
5. Tillandsia Cardenasii L. B. Smith (*Cardenas 491*), habit × ½.
6. Same, expanded sepal × 1.
7. Tillandsia Ehrenbergiana Kl. (*Ehrenberg 860*), habit × ½.
8. Same, expanded sepal × 1.
9. Tillandsia Schiedeana Steud. (*Lundell 2517*), scape and inflorescence of small specimen × ½.

Plate IV.

Fig. 1. Tillandsia Funckiana Bak. (*Jahn 1088*), short branch with 2 flowers × ½.
2. Tillandsia erecta Bak. (*Gillies*), habit × ½.
3. Tillandsia caerulea HBK. (*Humboldt & Bonpland*), upper scape and inflorescence × ½.
4. Same (*Hitchcock 21334*), petal × 1.
5. Tillandsia bryoides Griseb. (*Aurelius 23*), habit × ½.
6. Same, leaf × 2.
7. Same (*Osten 5107*), inflorescence × 2.
8. Tillandsia aizoides Mez (*Osten 13471*), leaf × 2.
9. Same (*Hieronymus & Niederlein 850*), inflorescence × 2.
10. Tillandsia Gilliesii Bak. (*Gillies*), habit × ½.
11. Same (*Castellanos 27/2880*), leaf × ½.
12. Same, cross-section of leaf-blade × 2.
13. Tillandsia myosura Griseb. (*Venturi 8096*), scape and inflorescence × ½.
14. Same (*Schreiter 27/2336*), leaf × ½.
15. Same, cross-section of leaf-blade × 2.
16. Tillandsia angulosa Mez (*Hieronymus & Niederlein 851*), habit × 1.
17. Tillandsia Landbeckii Phil. (*Landbeck*), inflorescence and upper scape × 1.
18. Tillandsia andicola Gill. (*Schreiter 1136*), habit × ½.
19. Tillandsia rectangula Bak. (*Castellanos 25/624*), end of stem with inflorescence × ½.
20. Tillandsia retorta Griseb. (*Venturi 1029*), habit × ½.
21. Tillandsia crocata (E. Morr.) Bak. (*Dusén 9238*), habit × ½.
22. Same (*Tweedie 427*), inflorescence and upper scape × ½.

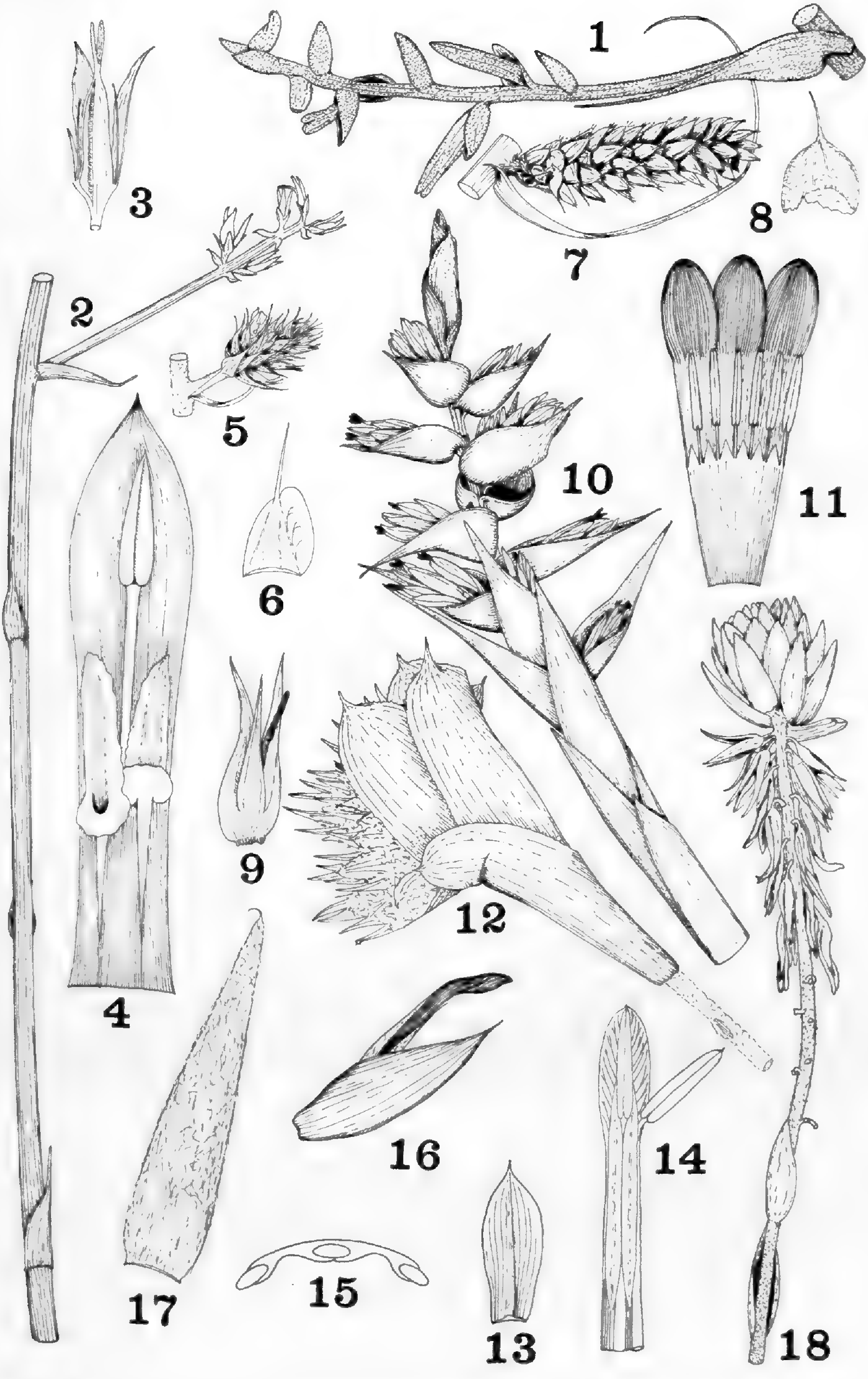

Fig. 1, Guzmania Hitchcockiana L. B. Sm.; 2–3, Hechtia Meziana L. B. Sm.; 4, Hohenbergia inermis Mez; 5–6, H. caymanensis Britton; 7–8, H. negrilensis Britton; 9, H. stellata Schult. f.; 10–11, Mezobromelia bicolor L. B. Sm.; 12–15, Canistrum perplexum L. B. Sm.; 16–17, Puya lasiopoda L. B. Sm.; 18, Pitcairnia kniphofioides L. B. Sm.

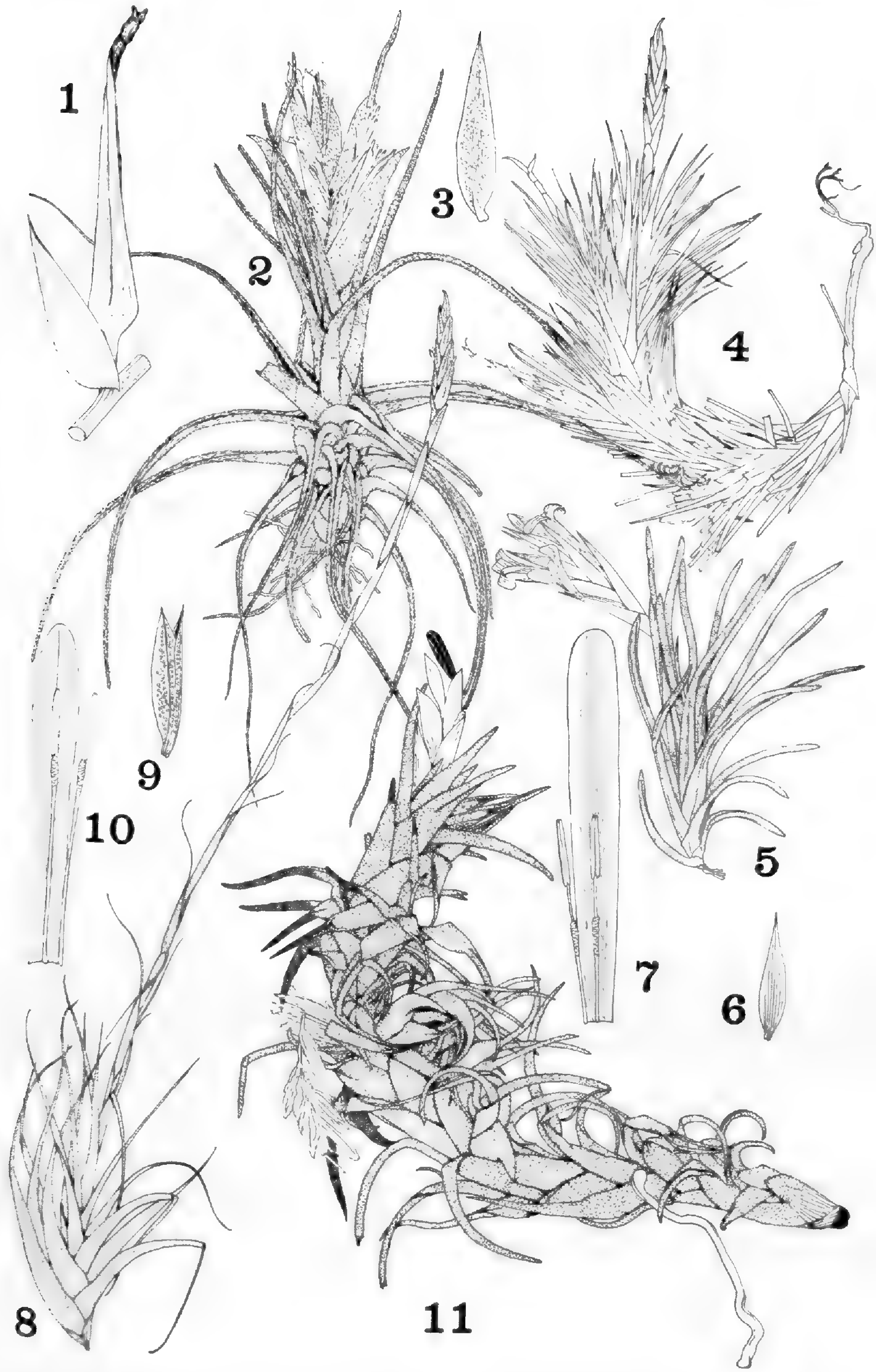

Fig. 1, PUYA SANCTAE-CRUCIS (Bak.) L. B. Sm.; 2–3, TILLANDSIA LEPIDOSEPALA L. B. Sm.; 4, T. CAULESCENS Brongn.; 5–7, T. ARGENTINA C. H. Wright; 8–10, T. INCARNATA HBK.; 11, T. FRIESII Mez.

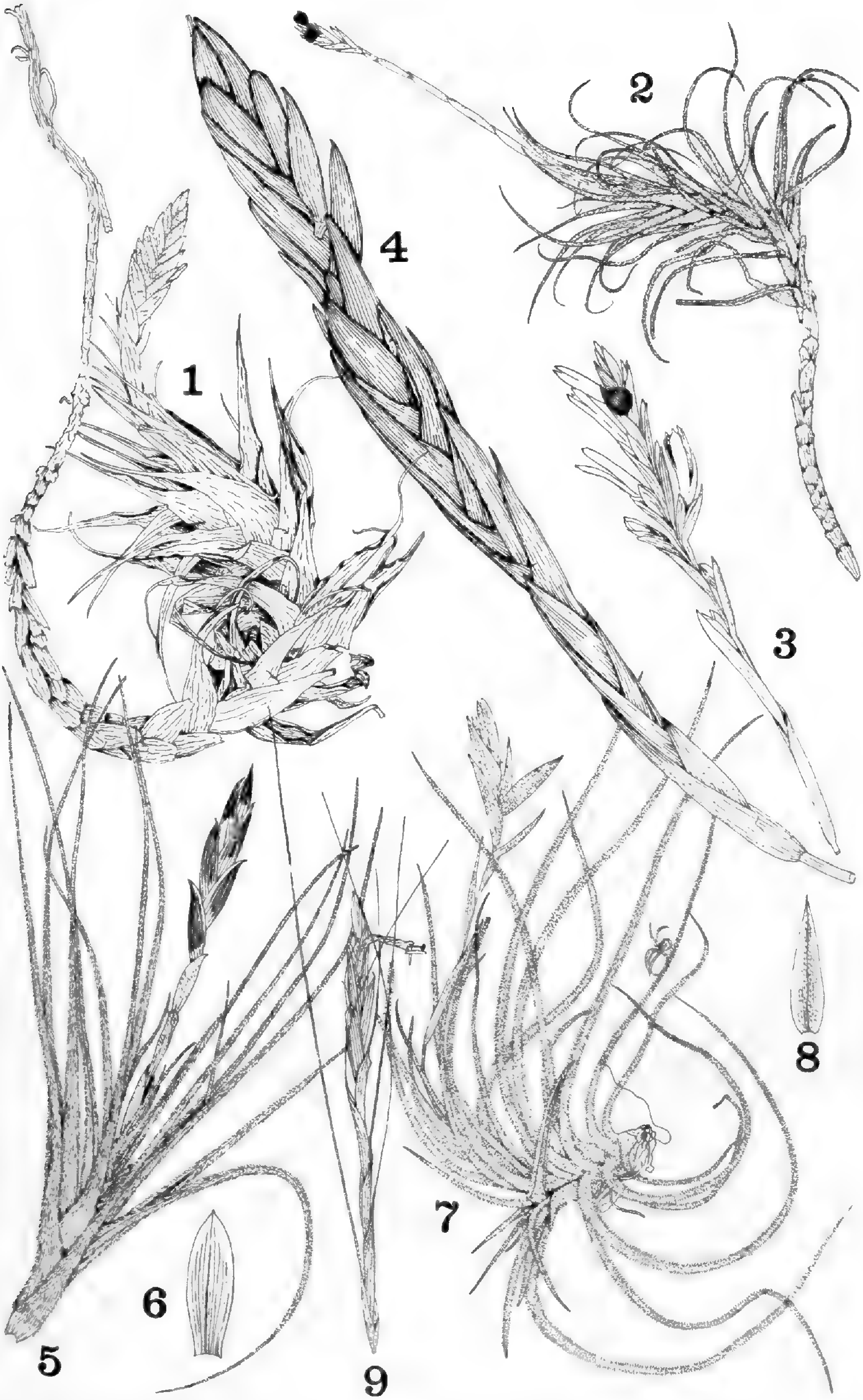

Fig. 1, TILLANDSIA CAULIGERA Mez; 2–3, T. ARHIZA Mez; 4, T. WERDERMANNII Harms; 5–6, T. CARDENASII L. B. Sm.; 7–8, T. EHRENBERGIANA Kl.; 9, T. SCHIEDEANA Steud.

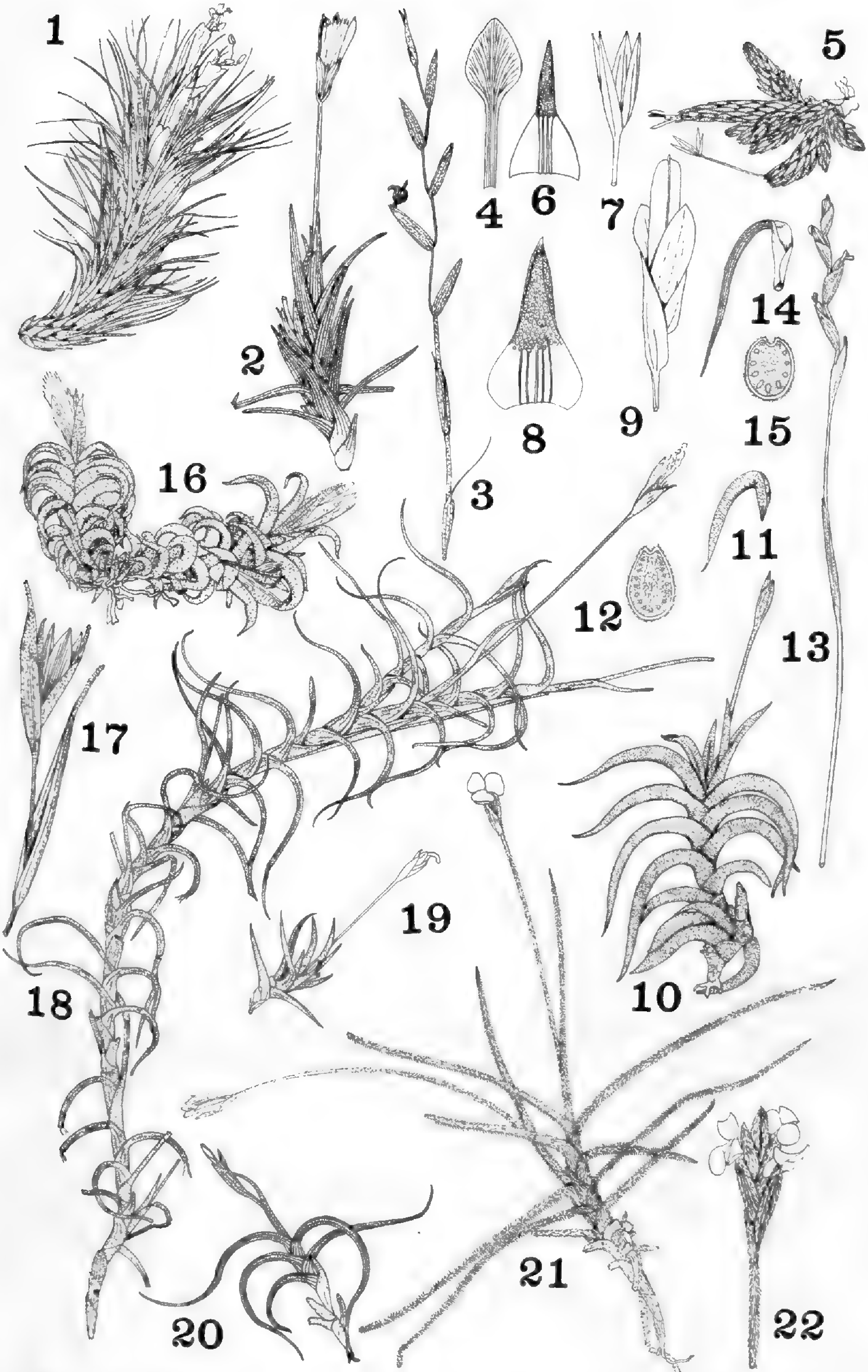

Fig. 1, TILLANDSIA FUNCKIANA Bak.; 2, T. ERECTA Bak.; 3–4, T. CAERULEA HBK.; 5–7, T. BRYOIDES Griseb.; 8–9, T. AIZOIDES Mez; 10–12, T. GILLIESII Bak.; 13–15, T. MYOSURA Griseb.; 16, T. ANGULOSA Mez; 17, T. LANDBECKII Phil.; 18, T. ANDICOLA Gill.; 19, T. RECTANGULA Bak.; 20, T. RETORTA Griseb.; 21–22, T. CROCATA (E. Morr.) Bak.

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THREE DAYS OF BOTANIZING IN SOUTHEASTERN VIRGINIA

By M. L. FERNALD AND LUDLOW GRISCOM

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Pages 129–157 and Plates 332–344 .... 1 April, 1935
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THREE DAYS OF BOTANIZING IN SOUTHEASTERN VIRGINIA

M. L. Fernald and Ludlow Griscom

(Plates 332–351)

In recent ornithological and botanical trips to the southeastern United States the junior author had been impressed with the distinctively austral elements which extend northward on the outer coastal plain and an earlier experience on a spring trip to the region of Back Bay in Princess Anne County, Virginia, had vividly indicated the need for fuller collections, especially in technical groups, from that southeast corner of the "Manual range." The first extensive collections from Virginia were those of the younger John Clayton, who botanized largely, for the time, in Gloucester County and doubtless elsewhere in eastern Virginia and secured plants from as far west as the Shenandoah Valley. Upon Clayton's collections Gronovius based his *Flora Virginica Exhibens Plantas Quas V. C. Johannes Clayton In Virginia Observavit atque collegit* (1739). Gronovius, with the aid of Linnaeus (then a young student) gave very detailed descriptions (but without binomials) of the Clayton plants, and in 1753 Linnaeus, in *Species Plantarum*, rested many scores of binomials wholly or primarily upon the Gronovian descriptions and the Clayton specimens, which he had formerly studied. Southeastern Virginia is, therefore, the type-region of a large number of Linnean species; and very detailed collecting is needed there in order clearly to interpret what Gronovius and Linnaeus actually had before them. To a great extent, of course, the identities can be determined through study of the actual specimens of Clayton, now scrupulously preserved at the British Museum of Natural History. Asa Gray and numerous other American botanists have made notes based upon study of these Clayton plants, and each of the present authors has studied special types. Unfortunately, however, no one without intensive knowledge of the flora of eastern North American, and particularly of eastern Virginia, can properly interpret them; for in many groups the plants of southeastern Virginia prove, upon field acquaintance, to be quite different from the more northern or inland species or varieties which have been identified with them.

With the double hope of securing fresh material of critical plants from not too far away from Clayton's collecting-grounds and of extending northward into southeastern Virginia species already known from the coastal plain of North or South Carolina, we left Cambridge, after a very early breakfast, on the morning of September 20, 1933, for the region of Cape Henry. With only five days before we must be back in Cambridge, no slack time was allowable; we reached Morristown, New Jersey, for lunch and drove aboard the Norfolk ferry at Cape Charles in the evening, 585 miles from Cambridge. Establishing ourselves at Virginia Beach we began, at noon on the 21st, three days of unremitting collecting: two sheets each of every species not already quite familiar or of members of technical groups in which special study seemed needed. Working far into the night and cutting sleep to a minimum we secured and brought back to Cambridge the series of specimens which forms the basis of this report. It very soon became evident that many species had been quite misinterpreted or hastily and inconclusively dealt with in the past; consequently our necessarily limited series, collected at the close of September, has occupied the late afternoons of many days during two academic years. And, even now, many highly technical groups can not be dealt with. They await further comparisons with the Clayton and other types of Linnaeus or with those of Walter, Lamarck, Poiret and Michaux and will be considered in a later paper.

One feature of the outer coastal plain of Princess Anne County, for which we were not prepared, was the relative abundance there of Alleghenian types, growing in close proximity to the typical coastal plain species. *Oxydendrum arboreum* is common; typical *Juniperus virginiana* of the limestone bluffs of Tennessee and Missouri abounds; and our collections include *Laportea canadensis* and some other upland species. The work of the late E. J. Grimes showed a similar intrusion into the outer coastal plain of plants typical of the interior. In Princess Anne County the presence of large areas of neutral to calcareous clays side-by-side with acid sands and peats seems to be the factor which favors this blending of floras. Further study of the region in the summer of 1934 by Fernald and Long greatly increased the number of Alleghenian species known in this outermost county of southeastern Virginia.

In the summer of 1934 the junior author studied many types in London and Paris, and from the discussions following it will be seen how frequently these have been misinterpreted. The case of *Lippia lanceolata* is typical. Michaux described the species from the outer coastal plain of South Carolina. No material of this plant was known to Asa Gray but a similar plant of the interior, having broader leaves, has regularly passed as *L. lanceolata,* Gray specially noting, in the Synoptical Flora, the plant of the interior with leaves "varying from obovate and lanceolate-spatulate to ovate" and Michaux's "name therefore inapt." We now have characteristic material from southeastern Virginia and southeastward on the coastal plain which shows that Michaux's name was "apt!"

Very recently the activity of the botanists of Virginia has found an outlet in the new journal, Claytonia; this evidence of renewed interest in the flora of the state is most welcome and much clarification of identities as well as knowledge of local distribution is looked for. The results, so far as yet worked out, of study of our own fruits of three days of collecting are here given. In some cases, it will be noted, our collections of September, 1933, are supplemented by the specimens secured in late July and early August, 1934, by Fernald and Long. The fuller report on this later collection is now being prepared by the senior author. In the illustration of the present paper we have had the unexcelled help of Professor J. Franklin Collins, who has freely given his services in preparing several of the plates, while others have been prepared by Mr. E. C. Ogden. The expenses involved in their preparation and in the making of the half-tone blocks have been met by a grant to the senior author from the Milton Fund for Research of Harvard University; and the large cost of reproducing the blocks has been most generously defrayed by Mr. Bayard Long. Our keen appreciation of and thanks to those who have thus aided us is here publicly expressed.

Juniperus virginiana and its northern Variety (Plates 332 and 333).—In the course of field-work in the South we and others before us (notably Mr. Francis Hunnewell and Dr. H. K. Svenson) have been greatly impressed with the very different aspect of much of the Red Cedar of the South as compared with that of the North. Many of the southern trees lack the stiff, narrowly pyramidal or spire-like outline so characteristic of the northern tree, the outline of the crown being more ovoid, with the lower branches widely spreading or more pendulous, regardless of whether the trees are fruiting or sterile. A thorough study of specimens shows that these habital differences are usually accompanied by certain technical characters. In much of the southern material, from southeastern Virginia to Missouri and southward, chiefly in argillaceous or calcareous areas, the leaves of the adult branchlets (pl. 332, figs. 1–3) are tightly appressed, rather broadly deltoid and obtuse or merely subacute, while the base of the seed has deep and conspicuous pits (plate 332, figs. 5–8). In the northern tree, of more sterile to acid soils, the leaves of the adult branchlets are narrower and attenuate to sharp and with usually less appressed tips (pl. 333, figs. 1–4), and the seeds (pl. 333, figs. 5–8) have only shallow basal pits. A large series of specimens from the coastal plain, from New Jersey to southeastern Massachusetts, is somewhat intermediate; while the characteristic northern extreme extends southward, chiefly in the mountains, to North Carolina and locally to Missouri.

In seeking the proper names for these two very real geographic varieties it is necessary first to identify typical *Juniperus virginiana* L. Linnaeus, Sp. Pl. 1039 (1753) quoted his earlier diagnosis from *Hortus Cliffortianus*, with references to Gronovius, Royen, Ray and Sloane. The latter, referring to a West Indian tree, can be dismissed as having nothing to do with the species of "Virginia, Carolina." The brief diagnoses in *Hortus Cliffortianus* and in Gronovius are not sufficiently definite to show which variety was in hand. The junior author, however, made close examinations of the specimens concerned while in London in the summer of 1934. The *Hortus Cliffortianus* specimen (no. 464) is the end of a young shoot, showing only the juvenile foliage and none of the appressed scales necessary for identification. The Clayton specimen (no. 884) which was the basis of the primary diagnosis of Gronovius is clearly the southern variety. In the Linnean Herbarium there is also a specimen of *J. virginiana*, and this is probably the northern extreme, although the mature scales are just forming and, consequently, are not wholly characteristic. In view of the fact that in the Species Plantarum Linnaeus gave no new diagnosis, his species should be typified by the first cited specimen which is identifiable. This is the Clayton specimen described by Gronovious. Typical *J. virginiana* is, accordingly, the broader- and blunter-leaved southern tree.

Many varietal, subspecific and specific names have been proposed within the group but they are all vague or confused in their application, except for numerous minor horticultural forms. *J. caroliniana* Mill. (1768),[1] *J. arborescens* Moench (1794) and *J. fragrans* Salisb. (1796) were mere renamings of *J. virginiana* L. *J. virginiana*, β, *J. caroliniana* Willd. (1796) was based on *J. caroliniana* Mill. *J. virginiana* **Hermanni* Pers. (1807), as defined, seems to have had the adult and juvenile foliage confused. *J. virginiana*, A. *vulgaris* Endl. (1822) was simply *J. virginiana* in the aggregate, as contrasted with his B. *australis*, which is *J. barbadensis* L. *J. virginiana*, var. *montana* Vasey (1876) was from Utah and Colorado, published without any stated technical characters; at least it is not the northeastern tree. It seems, therefore, that the two varieties, as such, have not been clearly differentiated; and that the northern more widely ranging extreme should be called

Juniperus virginiana L., var. **crebra** var. nov. (tab. 333), foliis maturis anguste ovatis acutis, apice vix arcte adpressis; seminibus basin versus leviter foveolatis.—Type: dry open gravelly soil, Barnstable, Massachusetts, July 24, 1919, *Fernald & Long*, no. 17,797 in Gray Herb.

Whereas the foliage of adult branchlets is usually distinctive, it is sometimes transitional; but the most fundamental difference is in the pitting of the seeds. Thus, specimens from "large trees with pendulous branches" collected near Waynesboro, Wayne Co., Tennessee (*Svenson*, no. 4308) are of such transitional material, with habit of typical *J. virginiana*, leaves (pl. 332, fig. 4) of var. *crebra*, but seeds (fig. 9) very definitely of the southern type. In separating the seeds from the flesh we have gently chewed hundreds of fruits. It is significant that fully ripe fruit of the southern typical *Juniperus virginiana* has a strong pitchy flavor without any ameliorating sweetness, whereas the ripe fruit of var. *crebra* usually has sweet flesh.

Triodia flava (L.) Hitchc., var. **Chapmani** (Small), comb. nov. *Sieglingia Chapmani* Small, Bull. Torr. Bot. Cl. xxii. 365 (1895). *Triodia Chapmani* (Small) Bush, Trans. Acad. Sci. St. Louis, xii. 74 (1902). *Tridens sesleriorides*, var. *Chapmani* (Small) Nash, Fl. Se.

[1] The detailed references are all given by Sargent in the Sylva.

U. S. 142 (1903).—Range extended north to southeastern Virginia: dry oak woods, "The Desert," Cape Henry, no. 2758.

T. flava, var. **aristata** (Scribn. & Ball), comb. nov. *Triodia seslerioides,* var. *aristata* Scribn. & Ball, U. S. Div. Agrost. Bull. xxiv. 45 (1900).

Var. *Chapmani* is distinguished from typical *Triodia flava* by its usually more pedicelled spikelets, which are commonly fewer-flowered, by its smoother and more attenuate lemmas, by the longer and more lanate tufts at the bases of the branches, and by the very slender basal sheaths. The branches are more inclined to be widely divergent. In our material all these characters are developed to an extreme degree, so much so that in the field we failed to recognize the true affinity of the plant.

Var. *aristata,* well characterized in the original diagnosis, seems to be a highly localized extreme in Florida.

In the extreme West and Southwest of the range of the species there are several minor tendencies but not sufficiently constant to merit taxonomic recognition. One of these was the basis for *Triodia cuprea,* var. *intermedia* Vasey, Contr. U. S. Nat. Herb. i. 201 (1892), published merely as a *nomen nudum* for C. S. Sheldon's no. 273 from near Fort Sill, Oklahoma (Indian Territory). This variety was afterwards validated by its publication with diagnosis as *Sieglingia seslerioides,* var. *intermedia* Vasey ex Dewey, Contr. U. S. Nat. Herb. ii. 539 (1894). Professor Hitchcock, who has kindly loaned us a sheet of Sheldon's collection in the United States National Herbarium, as well as the type of var. *aristata,* writes that the sheet no. 273 was not retained at Washington, and that, consequently, another (but unnumbered) sheet of Sheldon's material has there been taken to be the type. Fortunately, however, sheet no. 273, which was long ago sent in exchange from the National Herbarium to the Gray Herbarium, contains two culms, one of which has been returned to Washington. This material, although younger, seems to us to differ in no fundamental character from the other Sheldon plant which had been retained at Washington. Var. *intermedia,* as already intimated, seems hardly separable from typical *T. flava.*

Tricuspis seslerioides, var. *pallida* Holm, Proc. Biol. Soc. Wash. xiv. 19 (1901) is only a minor form with greenish spikelets.

Eragrostis hirsuta (Michx.) Nees. Admitted in the 2d edition of Britton & Brown (1913) on the basis of a report by Kearney. The species seems to be common in southeastern Virginia.

Spartina patens (Ait.) Muhl., var. juncea (Michx.) Hitchc.

Pools in sandy pine barrens, Cape Henry, Virginia, *Fernald & Griscom*, no. 2711.

The extraordinary habitat, strictly fresh pools, where it was associated with *Xyris* and other typical pine barren species, led us to hope that we had a unique *Spartina*. We are unable to find any character, however, to separate it from the ordinary plant of the coast.

Cinna arundinacea L., var. **inexpansa**, var. nov. (tab. 334, figs. 1 et 2), a forma typica differt paniculis contractis ramis valde adscendentibus; spiculis brevioribus 3.7–4.2 mm. longis; glumis lineari-lanceolatis, inferiore hyalina glabra carina scabra evanescenti excepta, superiore lemmati aequante vel quam eo breviore.—Type: damp woods, Virginia Beach, Virginia, August 8, 1934, *Fernald & Long*, no. 3648. Collected by us in edge of gum swamp, North Landing, Norfolk Co., no. 2732; damp pine barren, Macon's Corner, Princess Anne Co., no. 2733. Specimens, without definite locality given, from Louisiana, *Hall*, and from Oklahoma, 1891, *C. S. Sheldon*, no. 291, seen to be identical with ours.

Typical *Cinna arundinacea* of more northern or inland range, the type from Canada (presumably near Montreal), has the larger panicle in maturity with spreading to flexuous branches; the spikelets (fig. 3) 4.5–6 mm. long; 1st glume subherbaceous, hyaline only along the margin, strongly scabrous-hispid on the back, the 2d glume usually nearly equaling to exceeding the lemma. The typical plant follows south in the piedmont and upland regions to Georgia. Var. *inexpansa* is apparently confined to the Coastal Plain of the Gulf and Southeastern States. In southeastern Virginia it seemed to be frequent, but all the specimens seen in 1933 had the foliage badly damaged, probably by the violent storms of the summer.

Var. *inexpansa*, the most austral representative of the genus in the eastern United States, combines in a remarkable manner the technical characters of *Cinna arundinacea* and the boreal *C. latifolia* (Trev.) Griseb. The latter species, of circumboreal range, occurs generally from southern Labrador to southern Alaska, thence south into the wooded northern states and along the mountains of North Carolina (4000–6000 ft.), Tennessee (6500 ft.), Colorado and California. Yet, in its short spikelets with hyaline 1st glume *C. arundinacea*, var. *inexpansa* of the southern Coastal Plain is very close to *C. latifolia* (fig. 4). It has, however, the habit, unequal glumes, firm 2d glume and long anthers (1.2–1.5 mm. long, those of *C. latifolia* 0.5–0.8 mm.) of *C. arundinacea;* and numerous specimens from Oklahoma and Arkansas clearly connect it with the latter species.

Aristida lanosa Muhl., var. **macera**, var. nov. (tab. 335), a forma typica recedit culmis solitariis vel subsolitariis filiformibus 4.5–7 dm. high; foliis vix 2 mm. latis inflorescentia aequantibus vel superantibus, vaginorum tomento sparsiore; panicula 1–2.2 dm. longa ramis simplicibus quam plurimum 2 cm. longis; glumis subaequantibus 8–16.2 mm. longis; arista media 2.5–3.5 cm. longa; antheris 3–3.5 mm. longis.—Virginia: dry oak woods, Cape Henry, September 23, 1933, *Fernald & Griscom*, no. 2719 (type in Gray Herb.; isotype in herb. Griscom).

Typical *Aristida lanosa* is ordinarily 0.8–1.5 m. high, with stoutish culms often in tufts; the leaves much shorter than the culms, 3–6 mm. wide, with sheaths densely lanate; panicle decompound, 3–7 dm. long, with elongate branches; 1st glume 12–21 mm. long, notably exceeding the 2nd; middle awn 1.5–3 cm. long; anthers 5.5–6 mm. long. Var. *macera* was so very distinct in the field that its relationship to *A. lanosa* was not suspected, in spite of our having seen the latter in abundance the preceding day. Typical *A. lanosa*, in characteristic development, also occurs at Cape Henry, in sandy pine woods (our no. 2716),

Aristida purpurascens Poir., var. minor Vasey. In his recent *Critical Revision of the Genus Aristida* Henrard defines var. *minor* more sharply than was originally done by Vasey by giving measurements of the specimen accepted by Hitchcock as the type: 1st glume 9 mm. long, 2d glume 8 mm., lemma 6 mm., central awn 22 mm. Examination of 15 sheets from the extreme Southwest and the Gulf States shows this thinner-panicled and less cespitose extreme there to be the prevailing form. As a matter of fact, the maximum measurement for the 1st glume proves to be 9 mm. and the minimum 6.5 mm., with the majority 8 mm. or less. The variety ranges from Texas to Florida, thence northward near the coast to southeastern Virginia. Our collection, apparently the first from north of South Carolina, is from dry thickets, Cedarville, Norfolk Co., September 22, 1933, no. 2717. In the field the plant was not recognized as *A. purpurascens*, because of its small tufts and thin panicle.

Panicum longifolium Torr., var. Combsii (Scribn. & Ball) Fern. Rhodora, xxxvi. 69 (1934). Wet pine barrens, Macon's Corner, Princess Anne Co., no. 2737.

Not recorded by Hitchcock and Chase from north of Georgia.

Echinochloa pungens (Poir.) Rydb., var. **coarctata**, var. nov. (tab. 336, figs. 1 et 2), paniculis densifloris ramis coarctatis; spiculis 3.5–4.5 mm. longis valde aristatis; lemmatibus glabris vel dorso tantummodo puberulis sparse ciliatis spiculis bullatis.—Virginia: brackish marsh of North Landing River, Pungo Ferry, Princess Anne

Co., September 22, 1933, *Fernald & Griscom*, no. 2760 (TYPE in Gray Herb.; isotype in herb. Griscom).

When the combination *Echinochloa muricata* (Michx.) Fern., based on *Panicum muricatum* Michx. (1803), was proposed in RHODORA, xvii. 106 (1915) it was valid under the then existing International Rules. With the recent adoption of the homonym rule, however, it now becomes invalid because of the earlier *Panicum muricatum* Retz. (1786). The first available name for the species is *E. pungens* (Poir.) Rydb. Brittonia, i. 81 (1931), based on *Panicum pungens* Poir. in Lam. Encycl. Suppl. iv. 273 (1816), which was itself a substitute for the invalid *P. muricatum* Michx.

The varieties of *Echinochloa muricata* defined by Wiegand become

E. PUNGENS, var. **ludoviciana** (Wieg.), comb. nov. *E. muricata*, var. *ludoviciana* Wieg. RHODORA, xxiii. 58 (1921). FIG. 3.

Var. **occidentalis** (Wieg.), comb. nov. *E. muricata*, var. *occidentalis* Wiegand, l. c. 58 (1921). *E. occidentalis* (Wieg.) Rydb. l. c. 82 (1931).

Var. **microstachya** (Wieg.) comb. nov. *E. muricata*, var. *microstachya* Wiegand, l. c. 58 (1921). *E. microstachya* (Wieg.) Rydb. l. c. 82 (1931).

Var. **multiflora** (Wieg.) comb. nov. *E. muricata*, var. *multiflora* Wieg. l. c. 59 (1921).

Var. *coarctata*, described above, has the panicle with appressed-ascending and crowded branches as in var. *ludoviciana* but with awns as in typical *E. pungens*. It differs from the other described varieties in having the sterile lemma glabrous or merely puberulent on the back, with the bullate-based spicules few and marginal or very rarely on the keel.

ECHINOCHLOA WALTERI (Pursh) Nash, forma **breviseta,** forma nov., aristis brevibus 3.5–4.5 mm. longis.—VIRGINIA: by Northwest Branch of North Landing River, North Landing, Norfolk Co., September 22, 1933, *Fernald & Griscom*, no. 2761 (TYPE in Gray Herb., isotype in herb. Griscom).

With the characteristic spikelets and hispid sheaths of *E. Walteri*, but with extraordinarily short awns, typical and common *E. Walteri* having the awns usually 1–2 cm. long.

ANDROPOGON TERNARIUS Michx. var. **glaucescens** (Scribn.), comb. nov. *A. Elliottii glaucescens* Scribn. Bull. Torr. Bot. Cl. xxiii. 145 (1896). *A. Scribnerianus* Nash, Bull. N. Y. Bot. Gard. i. 432 (1900). Our plant from VIRGINIA: pine barrens and open sandy barrens, Cape Henry, nos. 2762, 2763.

Var. *glaucescens* is a well marked extreme but without good morphological characters to separate it from *A. ternarius*. In several cases specimens are definitely transitional. Our plants, representing the extreme variation, are, apparently, the first reported from north of Georgia, though material from North Carolina (Bat. Cave, Henderson Co., *Biltmore Herb.* no. 895^c) is equally characteristic.

We are unable, also, to keep apart as a species *A. Cabanisii* Hack. Numerous specimens are transitional from true *A. Cabanisii* to *A. ternarius* and its var. *glaucescens.* Extreme specimens are easily recognizable by the great reduction in length and abundance of the terminal internodal hairs of the rachis and by the more or less veiny backs of the sterile lemmas. As a variety this plant becomes

A. ternarius, var. **Cabanisii** (Hack.), comb. nov. *A. Cabanisii* Hack. Flora, lxviii. 133 (1885).

Although Hackel cited *A. Cabanisii* from Pennsylvania, and, after him, Nash stated the range as "Pennsylvania (according to Hackel) and Florida," we have seen no material from north of North Carolina (Raleigh, *Ruth,* no. 578). Florida specimens distributed by A. P. Garber in 1877 bear a printed label with the address, "Columbia, Penna." It is surmised that the "Pennsylvania" record was based on such a specimen.

The specific lines between *A. ternarius* and *A. Elliottii* Chapm. have not always been clearly stated, as the separation of the two species on the alleged greater development of the spathe in *A. Elliottii* proves completely to break down in *A. Elliottii,* var. *gracilior* Hack. Although *A. ternarius* can usually be recognized by its very long peduncles, while the racemes of *A. Elliottii* are largely or completely included within the fascicle of large spathes, this character also breaks, for an extreme of the latter, chiefly from inland stations, has many long-exserted peduncles. The most stable characters, as given by Nash, are as follows: in *A. Elliottii* the sessile spikelet 3.5–5 mm. long, narrowly linear-lanceolate, equaling or somewhat exceeding the internodes; pedicel of sterile spikelet usually much longer than the sessile spikelet. In *A. ternarius* the sessile spikelet is more broadly lanceolate, 5–6 mm. long, about twice as long as the internode and equaling or clearly exceeding the pedicel of the sterile spikelet. Inspection of material shows that these are really fundamental characters.

A. Elliottii, as originally defined by Chapman and as shown by a sheet which he sent to Asa Gray, is the common coastwise plant of the Southeast, with enlarged spathes and included or mostly included racemes. In the northern part of its range inland, locally in Delaware, Maryland, District of Columbia, western North Carolina and in southern Indiana, a well marked extreme occurs, in which most of the racemes are elevated on long peduncles, in this character suggesting *A. ternarius*. In this extreme the inflorescence is elongate, with well developed secondary lower branches. This plant, with notable geographic segregation, may be called

A. ELLIOTTII Chapm., var. **projectus**, var. nov., formae typicae simillima a qua differt inflorescentiis elongatis (2–4 dm. longis) fasciculis remotis, racemis superioribus valde exsertis longe pedunculatis.—TYPE from NORTH CAROLINA: open woods and abandoned fields, Biltmore, Buncomb Co., September 26, 1898, *Biltmore Herb.* no. 1421[c]. Other specimens are the following. DELAWARE: Wilmington, 1861, *Canby*. MARYLAND: sandy soil near Riverdale, October 3, 1911, *Holm*, as *A. argenteus*. DISTRICT OF COLUMBIA: old sterile field, Chevy Chase, September 24, 1922, *Agnes Chase;* without locality, September 22, 1896, *Steele*. INDIANA: Forest Reserve, Clark Co., *Deam*, no. 26,865.

A REVIEW OF ANDROPOGON VIRGINICUS AND A. GLOMERATUS (PLATES 337 and 338). In the northern half of the Atlantic coastal states botanists have long been familiar with two strikingly different plants, currently known as *Andropogon virginicus* L. (PL. 337, FIG. 1) and *A. glomeratus* (Walt.) BSP. (PL. 338, FIG. 3). The former, with slender culms and simple or subsimple, elongate inflorescences, is characteristic of dry habitats; the latter, with coarser culms and densely glomerate and subcorymbose or subturbinate inflorescences, of wet peats or marshes. From southeastern Virginia southward these two extremes, though very distinct in the North, are connected by a series of well marked variations, some of which have even been treated as species, but which in their spikelets show no definable differential characters.

The slender plant with simple or subsimple inflorescences (PL. 337, FIG 1), which has generally passed as *A. virginicus*, is treated, correctly (as shown by an examination of the type by the junior author and by a photograph of it sent to the Gray Herbarium), by both Hackel and Nash as true *A. virginicus:* var. *α*, *viridis*, subvar. 1. *genuinus* Hackel. Although Hackel distinguished various green and more or less glaucous plants as varieties and subvarieties, these characters, when not accompanied by other differences, seem of slight taxonomic importance. Typical *A. virginicus*, whether green or glaucous, passes insensibly into a commoner southern tendency (PL. 337, FIG. 3) with generally coarser habit and branching or paniculate inflorescences but without any apparent differences of spathes or spikelets. This is *A. tetrastachyus* Ell. Sk. i. 150 (1816) or *A. virginicus*, var. *tetrastachyus* (Ell.) Hack. in DC. Monogr. Phan. vi. 411 (1889). Although Nash does not recognize var. *tetrastachyus* as distinct from *A. virginicus*, it is very strikingly different in the field to northern-trained eyes and its concentration in the South but absence from the North marks it as a well defined geographic variety. Hackel conceived var. *tetrastachyus* as a plant with villous foliage, but this vegetative character is too fickle to be made the primary basis of varietal differentiation. Otherwise there seems to be no appreciable difference between var. *tetrastachyus*, as conceived by him, and his var. *viridis*, subvar. *ditior*, "paniculae valde ramosae rami primarii 2–3^{ni}, 3–5-nodes, secundarii 3–5^{ni}, 1–3-nodes, saepe tertianos procreantes," a plant of which Hackel pertinently remarked: "Transitum indigitat in A. macrourum, a quo tamen differt panicula laxa, laminis foliorum superiorum brevissimis nec paniculam aequantibus."

This variety, *A. virginicus*, var. *tetrastachyus* (including Hackel's var. *viridis*, subvar. *ditior*), strongly simulates another southeastern series of plants (PL. 337, FIG. 4) which have been separated as *A. macrourus* Michx., var. *glaucopsis* Ell. Sk. i. 150 (1816) and Hack. l. c. 409 (1889) or *A. glomeratus glaucopsis* (Ell.) Mohr, Bull. Torr. Bot. Cl. xxiv. 21 (1897). Although Nash subsequently made the combination *A. glaucopsis* (Ell.) Nash in Small Fl. Se. U. S. 62 (1903), it is apparent from his subsequent merging of his own *A. glaucopsis* with his earlier-published and very different *A. capillipes* Nash (PL. 337, FIG. 2), that his conception was a confused one, that glaucousness alone, regardless of other characters, was relied upon by him. True *A. macrourus*, var. *glaucopsis* was placed by Elliott and, following him, by Hackel under *A. macrourus* Michx. because the inflorescence has a tendency to produce glomerulate clusters. Examination of the type of *A. macrourus* shows that this identification was correct. Although theoretical *A. glomeratus* should have the leaves overtopping the inflorescence and the spathes scabrous, much of *A. macrourus* and material transitional to it has the leaves short and the spathes quite smooth, though the leaves in the extreme plant are very strongly pruinose-glaucous. It is this transitional series, very clearly described by Hackel as having a loose inflorescence and the spathes smooth, a characteristic of *A. virginicus* ("vaginis laminisque subtus valde pruinosus, glabris; panicula varietatis α [true *A. macrourus*], sed laxior"), extending north along with *A. virginicus*, var. *tetrastachyus* and true *A. macrourus* (PL. 337, FIG. 4) to southeastern Virginia, which makes it quite impossible to keep apart as valid species *A. virginicus* and *A. glomeratus*.

As a natural step from *A. glomeratus*, var. *glaucopsis* we pass in the same southern region directly to the much commoner var. *tenuispatheus* (PL. 338, FIG. 1), which usually has the inflorescence denser and thicker and more markedly glomerulate and which lacks the very pronounced bloom of var. *glaucopsis*. The var. *tenuispatheus* has the inflorescence elongate-ellipsoid, commonly 2–8 dm. long, but both northward and southward it passes imperceptibly into extremes with greatly shortened and corymbiform or turbinate panicles. The northern extreme (PL. 338, FIG. 3), with highly scabrous spathes is *A. macrourus*, var. *abbreviatus* Hack. l. c. 408 (1889). It has its greatest development from the District of Columbia and southern New Jersey to southeastern Massachusetts. Much farther south, especially from Florida to Texas, a similar extreme (PL. 338, FIG. 2), with exactly similar inflorescences, var. *corymbosus* Chapm. in Hack. l. c. 409 (1889), differs only in having the spathes smooth as in *A. virginicus*.

In the extreme South some other local variations of *A. virginicus* occur, which have been treated as distinct species, but these, having the simple inflorescences and smooth spathes of typical *A. virginicus*, do not specially concern us here. In order to show the variations (often treated as species) which seem to us to break down the reputed specific lines between *A. virginicus* and *A. glomeratus*, Professor J. F. Collins has most kindly supplied the photographs of typical panicles, × ½, reproduced as PLATES 337 and 338.

As we understand *Andropogon virginicus* it consists of the following variations which seem most worthy of recognition.

a. Inflorescence simple or subsimple: culms slender: plants of dry soil.
  Leaves flat, 2–5 mm. broad . . . . *A. virginicus*, var. *genuinus*.
  Leaves subfiliform, canaliculate, 1–2 mm. wide . . . . Var. *stenophyllus*.
a. Inflorescence branching, loosely to densely paniculate or corymbiform . . . . *b*.
  b. Branches of panicle never glomerulate: culms slender: plants of dry soil.
    Racemes only 1.5–2 cm. long . . . . Var. *glaucus*.
    Racemes 2.5–4 cm. long . . . . Var. *tetrastachyus*.
  b. Branches of panicle from slightly to strongly glomerulate or corymbiform: culms stout: plants mostly of wet pine barrens or swamps . . . *c*.
    c. Inflorescence elongate, not corymbiform: upper leaves shorter than to overtopping the culm.
      Leaves, especially of basal tufts, heavily white-pruinose: inflorescence rather lax, its upper half only 4–6 cm. in diameter . . . . Var. *glaucopsis*.

Leaves green or only slightly glaucous: inflorescences usually dense, their upper halves 0.6–2 dm. in diameter . . . . Var. *tenuispatheus.*

c. Inflorescence strongly corymbiform or subturbinate, often strongly overtopped by the upper leaves.

Spathes smooth . . . . Var. *corymbosus.*

Spathes strongly scabrous . . . . Var. *abbreviatus.*

A. virginicus L., var. **genuinus.** *A. virginicus* L. Sp. Pl. i. 1046 (1753). Var. *viridis,* subvar. *genuinus* Hack. in DC. Monogr. Phan. vi. 410 (1889).—Rather general in the Southern States, extending north on dry soils to Massachusetts, New York, Ohio, Indiana and Missouri; also Mexico. Pl. 337, fig. 1.

Var. **stenophyllus** (Hack.), comb. nov. *A. virginicus,* var. *viridis,* subvar. *stenophyllus* Hack. l. c. 411 (1889). *A. perangustatus* Nash in Small, Fl. Se. U. S. 62 (1903).—Georgia and Florida to Mississippi.

Var. glaucus Hack. l. c. 411 (1889). *A. capillipes* Nash, Bull. N. Y. Bot. Gard. i. 431 (1900).—North Carolina to Florida and Mississippi. Pl. 337, fig. 2.

Var. tetrastachyus (Ell.) Hack. l. c. 411 (1889). *A. tetrastachyus* Ell. Sk. i. 150 (1816). *A. longiberbis* Hack. Flora, lxviii. 131 (1885) *A. virginicus,* var. *viridis,* subvar. *ditior* Hack. l. c. 411 (1889). *Sorghum longiberbe* (Hack.) Kuntze, Rev. Gen. 792 (1891).—General in the Southern States, extending north to southeastern Virginia, Tennessee, southern Illinois, Missouri and Oklahoma; also in Mexico. Our collection from Virginia is: dry pine barrens, Cape Henry, no. 2764. Pl. 337, fig. 3.

Var. glaucopsis (Ell.) Hitchc. Am. Journ. Bot. xxi. 139 (1934). *A. macrourus* Michx. Fl. Bor.-Am. i. 56 (1803). *A. macrourus glaucopsis* Ell. Sk. i. 150 (1816); Hack. l. c. 409 (1889). *A. glaucopsis* (Ell.) Nash in Small, l. c. 62 (1903), at least as to name-bringing syn.—Very local, Florida to southeastern Virginia. Our collection from Virginia: edge of brackish marsh, Pungo Ferry, no. 2765. Pl. 337, fig. 4.

Var. **tenuispatheus** (Nash) comb. nov. *A. glomeratus tenuispatheus* Nash in Small, Fl. Se. U. S. 61 (1903). *A. tenuispatheus* Nash in N. Am. Fl. xvii^2. 113 (1912).—General in marshes and damp pine barrens in the Southern States, westward to southern Nevada and southern California and Mexico, north to southeastern Virginia and Arkansas. Our collection from Virginia: upper border of brackish marsh, Kempsville, no. 2766. Pl. 338, fig. 1.

Var. tenuispatheus, forma **hirsutior** (Hack.), comb. nov. *A. macrourus* γ, *hirsutior* Hack. l. c. 409 (1889).—Like var. *tenuispatheus* but sheathes conspicuously villous.—Georgia, Florida and Alabama.

Var. **corymbosus** (Chapm.), comb. nov. *A. macrourus,* ε, *corymbosus* Chapm. in Hack. l. c. 409 (1889). *A. corymbosus* (Chapm.) Nash in Britt. Man. 69 (1901), in part (as to southern plant).—Wet pine barrens, Florida to Arkansas, Texas and Mexico. Pl. 338, fig. 2.

Var. **abbreviatus** (Hack.), comb. nov. *Cinna glomerata* Walt.

Fl. Carol. 59 (1788), the type examined by the junior author in 1934. *A. glomeratus* (Walt.) B. S. P. Prelim. Cat. N. Y. 67 (1888). *A. macrourus* β, *abbreviatus* Hack. l. c. 408 (1889).—Marshes and wet pine barrens, southeastern Massachusetts to District of Columbia and North Carolina. PL. 338, FIG. 3.

THE VARIATIONS OF ANDROPOGON SCOPARIUS (PLATES 339 and 340). —In 1917 Mr. F. Tracy Hubbard pointed out that the typical *Andropogon scoparius* is the rather local plant of the Atlantic seaboard with strongly villous sheaths and blades. At that time Hubbard designated the widespread glabrous plants as var. *frequens* Hubbard, RHODORA, xix. 103 (1917), and concluded his article with a long discussion of var. *polycladus* Scribn. & Ball, to which he reduced the very striking plant of the northeastern seabeaches, *A. littoralis* Nash. His remarks, however, and the specimens he cited (omitting any citations from the type-region) indicate that his conception of var. *polycladus* had little to do with the plant of Scribner & Ball. In fact, Hubbard's citations show that any luxuriant or bushy-branched specimen of at least four well defined geographic varieties was called by him var. *polycladus*. Furthermore, the range given and the specimens labelled by him as var. *frequens* show that this concept was also a composite one. In attempting to make out the identities of our recent collections we have found that the species, *A. scoparius*, breaks into the following confluent but geographically somewhat isolated varieties, two of which are treated by Nash as species distinct from *A. scoparius*.

a. Joints of rachis beardless for the basal third, the bearding relatively sparse and short, grayish-white: robust plants chiefly of southern range.
Sheaths copiously villous: inflorescence relatively simple, with few appressed-ascending branches . . . . Var. *genuinus*.
Sheaths glabrous or more or less pubescent: inflorescence with very forking fastigiate branches, the lateral branches often horizontally divergent . . . . Var. *divergens*.
a. Joints of rachis bearded nearly or quite to base, the bearding often longer and whiter: usually more slender plants of northern or inland range. . . . *b*.
b. Glumes of fertile spikelet 4.5–6 mm. long: sterile rudiment, including awn, 2.5–5.5 mm. long: bearding comparatively sparse and short . . . . Var. *frequens*.
b. Glumes of fertile spikelet 6–11 mm. long: sterile rudiment, including awn, 3–10.5 (usually 6 or more) mm. long: bearding abundant and long. . . . *c*.
c. Racemes with 5–10 fertile spikelets, usually very flexuous; glumes 7–10 mm. long: rudiment 6.5–10.5 mm. long. Var. *septentrionalis*.
c. Racemes with (8–)11–19 fertile spikelets, rarely flexuous. . . . *d*
d. Inflorescence elongate, simple or subsimple, its branches little, if at all, fastigiate: rudiment 3–4.5 mm. long: plant of interior and western area. . Var. *neo-mexicanus*.

d. Inflorescence shorter, with abundant fastigiate branching: rudiment 5–8.5 mm. long: plants of Atlantic coast.
Sheaths only slightly compressed, often green: lower cauline blades barely exceeding the sheaths: glumes 6–8 mm. long . . . . Var. *ducis.*
Sheaths strongly compressed, usually very glaucous: lower cauline blades greatly exceeding the sheaths: glumes 8.5–10 mm. long . . . . Var. *littoralis.*

Var. **genuinus.** *A. scoparius* Michx. Fl. Bor.-Am. i. 57 (1803). *Pollinia scoparia* (Michx.) Spreng. Pug. ii. 13 (1815). *A. scoparius,* subsp. *genuinus,* forma or subvar. *typica* Hackel in DC. Monogr. Phan. vi. 385 (1889). *Sorhgum scoparium* (Michx.) Kuntze, Rev. Gen. 792 (1891). *A. scoparius villosissimus* Kearney ex Scribn. & Ball, Bull. U. S. Div. Agrost. 24: 41 (1900); Hubbard, Rhodora, xix. 101 (1917). *Schizachyrium scoparium* (Michx.) Nash in Small, Fl. Se. U. S. 59 (1903), at least as to source of name. *S. villosissimus* (Kearney) Nash, l. c. (1903).—Gulf States, locally north to Missouri and Kentucky and along the coast to Connecticut and Dukes and Nantucket Cos., Massachusetts. Plate 339, fig. 4.

The typical *A. scoparius* possibly extends farther north in the interior. Numerous specimens cited by Hubbard seem to be slightly pubescent individuals of other varieties, which differ from var. *genuinus* in characters of the racemes.

Var. divergens Hackel, l. c. 385 (1889). *A. divergens* Anderss. ex Hackel, l. c. as syn. Var. *polycladus* Scribn. & Ball, Bull. U. S. Div. Agrost. 24: 40 (1900); Hubbard, l. c. 103 (1917), in small part only.—Florida to Texas and Mexico, northward to Arkansas and, very locally, to Delaware Co., Pennsylvania. Plate 340, fig. 3.

The type-sheet of var. *polycladus* has been most kindly loaned to us by Professor Hitchcock. Its characteristic branching and robust stature indicate its identity with Hackel's *A. scoparius,* subsp. *maritimus,* β. *divergens* from Texas, characterized by "Rami floriferi robustiores, ... racemi robustiores . . . Paniculae pauperae rami bini, primarii 2–3-nodes, hinc inde ramulosi." This very striking variety has had an unfortunate career, being either completely ignored or quite misinterpreted.

Var. frequens Hubbard, Rhodora, xix. 103 (1917), as to type, but otherwise only in small part. *A. purpurascens* Muhl. in Willd. Sp. Pl. iv. 913 (1806). *A. flexilis* Poir. in Lam. Encyc. Suppl. i. 583 (1810). *A. scoparius,* subsp. *genuinus,* forma vel subvar. *flexilis* (Poir.) Hackel, l. c. 384 (1889).—Western New Hamsphire and eastern Massachusetts to central New York and locally to Minnesota, south to Florida, Alabama and Mississippi. Plate 339, fig. 3.

Hubbard's var. *frequens* included this and the next three varieties. The type (Block Island, *Fernald, Long & Torrey,* no. 8476) is the common and characteristic extreme in most of the eastern states, becoming rare westward and apparently unknown southwestward, or northeast of western and southern New England.

Var. **septentrionalis**, var. nov. (TAB. 339, FIGS. 1 et 2), var. *frequenti* simillima a qua differt racemis laxis flexuosis; spiculis sessilibus 7–10 mm. longis; spiculis pedicellatis rudimentariis arista inclusa 6.5–10.5 mm. longis; rachillae pilis valde longioribus densioribusque.—St. John Valley, New Brunswick to Michigan, south to northeastern Massachusetts, western Connecticut and northeastern New York. TYPE: Baie Sherley, Riv. Ottawa, QUEBEC, 15 sept. 1925, *Rolland*, no. 19,199 (in Gray Herb.). Nearly all specimens seen from Quebec, Maine and New Hampshire, and all from New Brunswick belong here as do the following: VERMONT: Burlington, 1883, *Brainerd;* Norwich, 1889, *M. A. Loveland;* West Townshend, 1915, *Wheeler.* MASSACHUSETTS: Salisbury, *Donald White*, no. 340; Malden, 1880, *H. A Young;* Randolph, 1898, *Churchill.* CONNECTICUT: Middletown, 1903, *Driggs.* NEW YORK: Lake George, 1900, *E. C. Kent;* Hudson Falls, 1899, *Burnham.* ONTARIO: Squirrel Island, Lambton Co., 1908, *C. K. Dodge.* MICHIGAN: Cheboygan Co., 1870, *Beardslee.*

Var. NEO-MEXICANUS (Nash), Hitchc. Proc. Biol. Soc. Wash. xli. 163 (1928). *A. neo-mexicanus* Nash, Bull. Torr. Bot. Cl. xxv. 83 (1898). *Schizachyrium neo-mexicanum* Nash in N. Am. Fl. xvii². 107 (1912).—The characteristic variety of the Rocky Mountain and Great Plains region, extending eastward along the Great Lakes to Lake Erie (Ontario, Ohio and Pennsylvania); apparently isolated in the Ottawa Valley and in the Androscoggin Valley, Maine. The extreme eastern collections are: QUEBEC: Ironside, valley of the Gatineau, *Rolland*, no. 15,291. MAINE: Gilead, 1897, *Kate Furbish.* PLATE 339, FIG. 5.

Var. **ducis**, var. nov. (TAB. 340, FIGS. 1 et 2), humilis; inflorescentiis fastigiatis; foliis viridiscentibus, laminis quam vaginis glabris et paullo compressis parum longioribus; spiculis sessilibus 6–8 mm. longis; spiculis pedicellatis rudimentariis arista inclusa 5–7.5 mm. longis.—Dukes, Nantucket and Barnstable Counties, MASSACHUSETTS. TYPE: steep, sandy bank, east side of West End Point, Naushon, August 31, 1927, *J. M. Fogg, Jr.*, no. 2940 (in Gray Herb.).

Most of the specimens from Dukes County (Martha's Vineyard and the Elizabeth Islands) are thoroughly characteristic, but some from Cape Cod are transitional to var. *frequens.* Var. *ducis* has often been mistaken for the more southern var. *littoralis* (including a part of var. *polycladus* of Hubbard), but it differs strikingly in its greener color, less compressed sheaths, shorter blades and shorter glumes. We have seen no material from Nantucket, but Bicknell's comment upon reporting *Schizachyrium littorale* from there was to the point: "Specimens collected are less notably different from *S.*

scoparium than are strongly developed examples from the Long Island and New Jersey coasts." Bicknell's observation thus coincides with our own, that var. *ducis* is intermediate between vars. *frequens* and *littoralis*.

Var. LITTORALIS (Nash) Hitchc. RHODORA, viii. 205 (1906). *A. littoralis* Nash in Britt. Man. 69 (1901). *Schizachyrium littorale* (Nash) Bickn. Bull. Torr. Bot. Cl. xxxv. 182 (1908), as to type.—Beaches and dunes, southern Connecticut to southeastern Virginia. PLATE 340, FIG. 4.

Var. *littoralis* is so pronounced in its extreme development as to appear specifically distinct from the other varieties which are geographically adjacent, such, for instance, as vars. *divergens* and *frequens*. As will be seen, however, from an inspection of the key, vars. *septentrionalis, neo-mexicanus* (which on the sands of the Great Lakes has been identified as var. *littoralis*) and *ducis* completely bridge the morphological differences between these marked extremes. As already noted, on Cape Cod var. *ducis* clearly passes into the continental var. *frequens;* furthermore, the only Connecticut material we have seen of var. *littoralis* is greener than the plants of southern New York, New Jersey, Delaware and Virginia and is thus transitional to var. *ducis*.

VARIATIONS OF ANDROPOGON PROVINCIALIS.—The common grass which has long been known as *Andropogon furcatus* Muhl. (1806) must, unfortunately, take the earlier and inappropriate name *A. provincialis* Lam. (1783). This was based on specimens in cultivation or escaped from cultivation in Provence in southern France. Although Hackel treats the common *A. furcatus* of eastern America as a subvariety, the slight character which he ascribes to the plant introduced into France is found in a large number of American specimens. The native American plant is currently divided by Nash into four so-called species: *A. provincialis, A. chrysocomus* Nash, *A. tennesseensis* Scribn. and *A. paucipilus* Nash. Of these, *A. tennesseensis* is so trivial a variation, by no means confined to Tennessee, that it seems unworthy of recognition even as a form, a course just taken by Hitchcock in Small's Manual.

A. paucipilus is a well marked, rare and local extreme of Nebraska and Montana; but aside from its essentially glabrous racemes, the internodes with at most a few weak hairs, it has no morphological characters to separate it from the less pubescent tendencies of *A. provincialis*.

A. chrysocomus is a striking variation in the opposite direction, with the hairs of the internodes of the rachis more abundant, twice as long as in typical *A. provincialis* and, in its extreme development, yellowish in color. Except for the extreme development of beard there seems to be nothing to separate *A. chrysocomus* from *A. provincialis.*

The two extreme variations seem to us better treated as

A. PROVINCIALIS Lam., var. **paucipilus** (Nash), comb. nov. *A. paucipilus* Nash in Britt, Man. 70 (1901).

A. PROVINCIALIS Lam., var. **chrysocomus** (Nash), comb. nov. *A. chrysocomus* Nash, l. c. (1901).

Nash gives the range of the latter as "Nebraska and Wyoming to Texas," but recent collections show that it extends into southwestern Missouri.

CYPERUS IRIA L., var. **Santonici** (Rottb.), comb. nov. *C. Santonici* Rottb. Descr. Icon. Nov. Pl. 41, t. ix. fig. 1 (1773).

Botanists of the Orient have long recognized two marked trends in *Cyperus Iria*, which have been ignored by New World students. The commoner extreme is the slender-spiked plant which was beautifully illustrated by Plukenet. Linnaeus also cited a plate of Rheede, which, according to C. B. Clarke, is *C. inundatus* Roxb. Since Linnaeus had no specimens, the Plukenet plate must stand as the type. The typical variety, common in southeastern Asia as well as the southeastern United States, has the very short spikelets (2–10-flowered) practically sessile and alternately and irregularly crowded on both sides of the ultimate branches of the umbel, forming slender spiciform branches.

The other extreme, *Cyperus Santonici*, has much longer linear spikelets (10–22-flowered), terminating the ultimate branches of the umbel, forming shorter and thicker and looser ultimate racemes. Students of the oriental flora have treated this variety as typical *C. Iria*, and have considered the slender-spiked *C. Iria* as var. *microiria* (Steud.) Franchet & Savatier or as var. *paniciformis* (Franch. & Sav.) Clarke, or even as a separate species, *C. microiria* Steud. or *C. paniciformis* Franch. & Sav.

Typical *Cyperus Iria* is well known in our southeastern states, though it is significant that in 1860 Chapman knew of only a single station (Santee Canal), where it was considered as "Probably introduced from Eastern Asia." The abundance of the plant on roadsides and in clearings from North Carolina southward indicates a rapid naturalization.

The plant of southeastern Virginia (our nos. 2783–2785) proves to be not the typical *C. Iria* but the var. *Santonici*, which apparently has not been previously collected in America.

Hitherto the only basis for the inclusion of *C. Iria* in the Gray's Manual range has been a single collection at Hempstead, Long Island, first recorded in the 2nd edition of Britton & Brown's Illustrated Flora, a weed in a potato field, found by the late E. P. Bicknell in 1907. This plant, a sheet of which is before us, proves to be neither typical *C. Iria* nor var. *Santonici*, but is referable to *C. amuricus* Max. Prim. Fl. Amur. 296 (1859), a close relative of *C. Iria*, with which it has often been confused. One of the original specimens of *C. amuricus*, in the Gray Herbarium, is closely matched by Japanese material, differing at once from *C. Iria* in the prolonged midribs of the scales which project as definite cusps or mucros. *C. amuricus*, like *C. Iria*, seems to have a weedy tendency and is introduced in Italy, being *C. Iria*, var. *acutiglumis* Fiori, Fl. Ital. Exsicc. Ser. II. no. 1231 (1908). The plant, however, had an earlier varietal designation in *C. amuricus*, var. *iaponicus* Miq. Prolus. Fl. Jap. (1866–67), which was based on a trivial difference in color of the scales.

Cyperus ferax and C. ferruginescens.—The annuals variously known in American floras as *Cyperus ferax* Richard, Act. Soc. Hist. Nat. Paris, i. 106 (1792), *C. speciosus* Vahl, Enum. ii. 364 (1806) and *C. Michauxianus* Schultes, Mantissa, ii. 123 (1824) have never been clearly understood. Material identified under any one of these names occurs in our older herbaria, with an undifferentiated range from the Atlantic to the Pacific and south throughout tropical America; in habitat ranging from salt marsh to rich river-alluvium and prairie. In attempting to identify our own material it has been necessary to trace the various names to their sources.

C. ferax, the earliest described of the series, came originally from Surinam (Dutch Guiana), and an excellent photograph of the type (received through the Rockefeller Foundation and the Field Museum) shows it to be the plant characteristic of brackish or saline shores from tropical America north to Massachusetts and on the Pacific coast to California. This species is characterized by its coriaceous or subcoriaceous scales which are 2–3.5 mm. long, drab to brownish and inclined to be lustrous. Its achenes are 1.5–2 mm. long, ellipsoid to very narrowly obovoid, dull gray to blackish when ripe, with relatively coarse superficial pebbling.

Cyperus speciosus was described from Virginia, where *C. ferax* is abundant on the coast, as having the scales of the spikelets "linear" and leaves of the involucre only 2 lines wide. Torrey, following Elliott, applied this name to plants of the South "bearing conspicuous partial as well as general involucres." We know that in well developed umbels *C. ferax* may have them. Torrey did not know of *C. ferax* Richard and he applied to the smaller coastal plant with only primary involucres the name *C. Michauxianus* Schultes. This latter name was a substitute for *C. strigosus* Michx., not L.

In his extensive publication on the *Cyperaceae* of the Berlin Herbarium, Boeckeler performed some remarkable nomenclatural shuffles, restricting *C. ferax* to South America, and using the combination *C. Michauxianus* Torr. ("excl. syn Schult."), in spite of the fact that Torrey had explicitly stated that his *C. Michauxianus,* like that of Schultes, "is clearly the *C. strigosus* of Michaux, as I have ascertained by examining his herbarium." Of course *C. Michauxianus* of Torrey and of Schultes, earlier, are identical, being based on the identical type. Nevertheless, Boeckeler refrained from stating what he took to be *C. Michauxianus* of Schultes.

After attempting to find any character to distinguish these various plants we are forced to treat them as a single wide-ranging species for which *C. ferax* is the earliest name.

As to *Cyperus speciosus,* which Vahl based upon a specimen "ex herbario horti parisini," letters to Paris have brought the uniform reply that the type could not be found. The junior author, when in Paris in July, 1934, made a special search for this sheet with the expert assistance of Monsieur Léandri. It was finally located, but has always been previously overlooked, as the name *C. speciosus* does not occur on the sheet, nor did Vahl make any annotations. The evidence for this sheet being Vahl's type is as follows. There is only one label, bottom, left, in ink, which reads

Trasi Virgin. panic. speciosa sparsa herbier du Vaillant.

Now, Vahl, Enum. ii. 364 cites *C. specious* as being *ex herb. Vaillant,* and uses the same words in his third paragraph of diagnosis, merely substituting "*Cyperus*" for "*Trasi:*"

Cyperus virginianus panicula sparsa speciosa Herbarium Vaillantii.

Finally, this is the only Vaillant specimen of the species *C. ferax* and all its synonyms in the Museum.

The plant on the sheet is the culm and 2 inches of stem of a very large and long-branching specimen of *Cyperus ferax* with long spikes, consequently lacking the congested appearance of many plants of that species. In technical characters it is NOT *C. erythrorhizos* nor *C. ferruginescens* but is the familiar *C. ferax* at a glance.

Boeckeler described two new species, *Cyperus ferruginescens*, Linnaea, xxxvi. 396 (1869–70) and *C. parvus*, l. c., both based on material sent by Engelmann from St. Louis, Missouri. The latter is clearly nothing but a depauperate state of the former. A sheet of the type-collection of *C. ferruginescens*, gathered by Engelmann near St. Louis, Missouri, in September, 1845 and sent to Gray as *C. Michauxianus* Schult. is a characteristic specimen of a species with small, opaque and membranaceous, instead of coarser, lustrous and coriaceous scales, which rarely exceed 2 mm. in length. The inflorescence of *C. ferruginescens* usually has a positively ferruginous coloring, that of *C. ferax* being drab to fuscous or, in the other direction, yellowish; the achenes of *C. ferruginescens* are also ferruginous or golden-brown, 1–1.5 mm. long, and shorter-oblong. *C. ferruginescens* occurs chiefly in the richer soils of the interior, coming eastward to the Connecticut and the Potomac valleys and extending westward to the Pacific. It has been distributed as *C. speciosus, ferax* or *erythrorhizos*, all of which it superficially simulates. In 1886 Dr. Britton considered it only a variety of *C. speciosus* Vahl, calling it *C. speciosus*, var. *squarrosus* Britt., Bull. Torr. Bot. Cl. xiii. 214 (1886); but he was then treating *C. speciosus* (including *C. speciosus*, var. *parvus* (Boeckl.) Britt. l. c.) as specifically distinct from *C. ferax* Richard.

The Variations of Cyperus strigosus (Plate 341). The widely dispersed species, *Cyperus strigosus* L. Sp. Pl. i. 47 (1753), has had many varieties proposed and at least three specific segregates. In searching for morphological characters to separate all these concepts we have spent many days in a study of the series. *C. strigosus* var. *capitatus* Britton, Bull. Torr. Bot. Cl. xiii. 221 (1886), wrongly ascribed to Boeckeler, who gave no name to it, seems to us only starved individuals with congested inflorescences. Var. *compositus* Britton, l. c., as shown by specimens so identified by Dr. Britton, is a series of more luxuriant plants with a compound umbel; while var. *gracilis* Britton, l. c. is another depauperate (or "drawn") state.

Var. *elongatus* (Torr.) Britton, l. c. was based on *C. Michauxianus*, β. ? *elongatus* Torr. Ann. Lyc. N. Y. iii. 432 (1836). Whether Torrey's type (*Drummond*, no. 337, from Texas) belonged to *C. strigosus* seems very doubtful. Torrey explicitly said of it: "much resembles *C.*

strigosus . . . but in the structure of the spikelets, it is nearer *C. Michauxianus*"; and Britton stated that he had never seen the Torrey type. Neither have we been able to locate it. Var. *robustior* Britton, l. c., based on *C. strigosus* β. Kunth, Enum. ii. 88 (1837), seems to be a well defined geographic variety, characterized by its very long (10–25-flowered) spikelets which are 2–3 cm. long; it is essentially a plant of the southeastern coastal plain, north locally to Martha's Vineyard and, in the interior, to southern Indiana and Missouri. Much of the material so named in collections is merely large *C. strigosus*.

One of the great technical difficulties in this species and its allies is the fact that quite immature specimens have subterete and not strongly compressed spikelets; consequently, immature specimens cannot be identified by keys which, in so technical a group, have to be based on mature fruiting material. On at least two occasions supposed new species have been based on such immature specimens. *C. uniflorus* Torr. & Hook. in Torr. l. c. 431 (1836), of which an isotype (our FIG. 2) is before us, was based on *Drummond's* no. 287 from Texas. It is wholly immature and is quite inseparable from much material in similar development from the northeastern states (see FIGS. 4 and 7). *C. Hanseni* Britton in Abrams, Ill. Fl. Pacif. States, i. 260, fig. 621 (1923), was based upon immature material ("young achene narrowly linear") from Amador County, California, with a stated range including Shasta Co. and the Sacramento Valley. Some of the earlier collections had been erroneously referred to C. *stenolepis* Torr. by Sereno Watson. This and some other material is before us and, again, it (see FIG. 5) is absolutely indistinguishable from innumerable immature specimens of *C. strigosus* from the breadth of the continent (FIG. 7 from Massachusetts).

Cyperus stenolepis Torr. l. c. 263 (1836) is in many ways the most extreme variety of *C. strigosus*, usually maintained as a species in works on the southern flora. It is characterized by luxuriant development, with the very numerous spikelets becoming lax, and with loosely spreading scales in maturity. In typical form it occurs chiefly from Florida to Louisiana, but it extends northward to North Carolina (whence the type) and locally to West Virginia. Dr. Gleason informs us that the type specimen cannot be found in the Torrey Herbarium; but Britton, in his synopsis of the genus, accepted it in the sense defined above and, until the type is discovered and proves to be something different, the name should be applied in its current sense. We agree with Kükenthal in treating it as *C. strigosus*, var. *stenolepis* (Torr.) Kükenth. in Fedde, Rep. Spec. Nov. xxiii. 189 (1926).

Cyperus retrorsus and its Variations (Plate 342). The widespread species long known as *Cyperus cylindricus* (Ell.) Britton, Bull. Torr. Bot. Cl. vi. 339 (1871) became *C. Torreyi* Britton, Bull. Torr. Bot. Cl. xiii. 215 (1886) because of the earlier and different *C. cylindricus* Boeckl. (1859). In studying this variable species we have been unable, however, to keep *C. Torreyi* (1886) apart from *C. retrorsus* Chapm. Bot. Gaz. iii. 17 (1878). The latter (our figs. 1 and 2) represents one extreme of a series which includes the species *C. Nashii* Britton (figs. 3 and 4), *C. Deeringianus* Britton & Small (figs. 7 and 8) and *C. Torreyi* Britton (figs. 5 and 6), as treated in Small's Manual. So far as we can determine there are no fundamental differences between these plants, each of which has a distinctive range; and abundant intergradient specimens occur. As we should treat *C. retrorsus* it consists of the following varieties.

C. retrorsus Chapm., var. **typicus**. *C. retrorsus* Chapm. Bot. Gaz. iii. 17 (1878). *C. retroversus* Chapm.[1] Fl. So. U. S. ed. 2, 1st Suppl. 659 (1883), obvious *lapsus* for *C. retrorsus*, corrected in ed. 3.—Spikelets very densely crowded, the lower becoming reflexed, 2–3.5 mm. long, forming slenderly cylindric to slightly clavate spikes 0.9–2 cm. long.—Florida to Alabama and South Carolina (fragment of type at New York Bot. Gard. examined through courtesy of Dr. Gleason). Figs. 1, × 1, and 2, × 4, from Florida material closely matching Chapman's type.

Var. **Nashii** (Britton), comb. nov. *C. Nashii* Britton in Small, Fl. Se. U. S. 1321 and 1329 (1903).—Spikelets less crowded, 2–3.5 mm. long, the lower more spreading, in ellipsoid-cylindric spikes 4–9 mm. long.—Heretofore recorded only from central Florida, but now extended north to southeastern Virginia: Virginia Beach, *Randolph*, no. 324; Cape Henry, *Fernald & Griscom*, no. 2792, *Fernald & Long*, no. 3730. Figs. 3, × 1, and 4, × 4, from duplicate type of *C. Nashii*.

Var. **cylindricus** (Ell.), comb. nov. *Mariscus cylindricus* Ell. Sk. Bot. S. C. and Ga. i. 74 (1816). *C. ovularis*, γ *cylindricus* (Ell.) Torr. Ann. Lyc. N. Y. iii. 279 (1836). *C. cylindricus* (Ell.) Britton, Bull. Torr. Bot. Cl. vi. 339 (1879), not Boeckl. (1859). *C. Torreyi* Britton, Bull. Torr. Bot. Cl. xiii. 215 (1886).—Spikelets less crowded than in var. *typicus*, 3–5 mm. long, the lower rarely much reflexed, forming short-cylindric spikes 0.5–1.5 cm. long.—Texas to Florida, north to southern New York. Figs. 5, × 1, and 6, × 4, from type region (Georgia) of *Mariscus cylindricus* Ell.

Var. **Deeringianus** (Britton & Small), comb. nov. *C. Deeringianus* Britton & Small in Small, Man. 151 and 1503 (1933). *C. cylindrostachys* Am. auth., not Boeckl. (1869–70). The coarsest and largest extreme, with spikelets 4–5 mm. long, the lower reflexed as in var.

[1] Name not in *Index Kewensis*.

typicus, forming simple or basally compound ellipsoid to long-cylindric spikes 1–3 cm. long.—Mississippi to Florida and Georgia, here extended north to southeastern VIRGINIA: wet clearings near Grassfield, Norfolk Co., *Fernald & Long*, nos. 3723, 3724; near Great Bridge, Norfolk Co., *Fernald & Long*, no. 3725. FIGS. 7, × 1, and 8, × 4, from Virginia material (no. 3725).

Although the varieties in their extremes are quite recognizable such a complex of transitional colonies occurs that many specimens can be placed only approximately. The achenes of the four varieties seem essentially identical.

CYPERUS FILICULMIS Vahl, var. **oblitus**, var. nov. (TAB. 343, FIGS. 1 et 2), spiculis brevibus 2–4-floris ut in var. *macilento*, sed umbellis valde evolutis radiis elongatis subaequilongis plerumque 5–15; bracteis involucri 5–7 elongatis quam radiis duplo vel usque quintuplo longioribus.—Sandy coastal plain, Maryland to Florida. TYPE: dry pine barrens, Cape Henry, Princess Anne Co., VIRGINIA, September 24, 1933, *Fernald & Griscom*, no. 2793 (in Gray Herb.; isotype in herb. Griscom).

Var. *oblitus* has usually been mistaken for *Cyperus echinatus* (Ell.) Wood, Class-book, 734 (1863)[1] or *C. Baldwinii* Torr. (1836), now passing as *C. globulosus* Aubl. (1775). We have not seen material from Cayenne, whence Aublet described his species, but *C. echinatus* (Ell.) Wood is well matched by West Indian material identified by Britton as *C. globulosus*. From *C. filiculmis*, var. *macilentus* Fern. the new var. *oblitus* differs in its nearly spherical and very full glomerules and in the greater development of the umbel. Var. *macilentus* (FIG. 3) ordinarily has a single terminal glomerule or 1 or 2 short and unequal rays subtended by 2–4 (rarely –5) relatively short bracts; it is widely distributed in the North, from central Maine and southwestern Quebec to Minnesota, south to the coast of Virginia and to Ohio, Indiana, Illinois and Missouri.

Typical *Cyperus filiculmis* of the Atlantic slope is technically a very difficult plant to classify, since it displays the fundamental characters of true *Cyperus* and, at the same time, the diagnostic character of *Mariscus* Gaertn. (1788), not Zinn (1757); *i. e.* the scales sometimes fall away from the rachis of the spikelet, as in *C. Schweinitzii* Torr. and *C. Houghtonii* Torr., or the whole spikelet is deciduous above the basal empty scales, as in *C. strigosus* L. Specimens with deciduous scales were described as *C. Bushii* Britton, Man. 1044 (1901), from the Great Plains States; but many individuals from Missouri or Oklahoma show mature spikelets disarticulating from the rachis

[1] Name not found in *Index Kewensis*.

(fig. 4). Similarly, on the Atlantic slope *C. filiculmis,* although theoretically with persistent scales, often loses them before the fall of the rachis of the spikelet (figs. 5 and 6). It seems impossible, therefore, to keep *C. Bushii* apart from *C. filiculmis* or the genus *Mariscus* Gaertn. apart from *Cyperus* L.

Extreme specimens of *Cyperus Schweinitzii* with unusually full inflorescences simulate *C. filiculmis,* as do some phases of *C. Houghtonii.* They may be separated by the following key:

Scales acuminate, 3.5–4.5 mm. long, the midrib excurrent as a mucro up to 1 mm. long: achenes 2.5–3.5 mm. long; culms scabrous. . . . . *C. Schweinitzii.*
Scales rounded at summit, the midrib scarcely or not at all excurrent: achenes at most 2.3 mm. long.
  Achenes short-ellipsoid, ⅔ as broad as long, 1–1.5 mm. broad. *C. Houghtonii.*
  Achenes slenderly oblong-trigonous (as in *C. Schweinitzii*), more than twice as long as broad, less than 1 mm. wide. . . . . *C. filiculmis.*

In the Southeast *Cyperus filiculmis,* var. *oblitus* is easily confused with *C. globulosus* Aubl.; in fact most of the material of this variety has been erroneously distributed as the latter species, due to the inadequacy of current keys. In *C. globulosus* the bases lack the great development of hard corms which mark *C. filiculmis.* The spikelets of *C. globulosus* are slender-pointed and the rachis is broadly winged as in *C. Grayii.* It seems to us that *C. subuniflorus* Britton in Small, Fl. Se. U. S. 173, 1327 (1903), based on *C. uniflorus,* var. *pumilus* Britton, Bull. Torr. Bot. Cl. xi. 87 (1884)[1] is merely small individuals of *C. globulosus.* Several sheets in the Gray Herbarium show both collected as one. We are, likewise, unable to keep out of *C. globulosus* the tropical *C. panamensis* (Clarke) Britton (1925), based on *Mariscus panamensis* Clarke, Kew. Bull. Add. Ser. viii. 15 (1908).

Psilocarya scirpoides Torr., var. **Grimesii,** var. nov. (tab. 344, figs. 1 et 2), formae typicae simillima, major; spiculis lanceolato-cylindricis, lateralibus longius pedicellatis; squamis late lanceolato-acuminatis; bracteolis chartaceis vix herbaceis plerumque enervosis.—

[1] In elevating to specific rank as *C. subuniflorus,* ascribed to Britton, a variety previously published by Britton, Dr. Small cited as its type merely "*Cyperus uniformis* var. *pumilus* Britton, not *C. pumilus* L.," without taking the trouble, comparatively slight for him at the time (and surely intended by the rule for transference or alteration of names which justly requires "the citation of a previously and effectively published description of the group under another name") to record the place and time of publication of *C.* "*uniformis*" var. *pumilus.* After considerable time-consuming search we have found that Britton described a *C. uniflorus,* var. *pumilus,* which, it is assumed, was what Small meant. It would be quite justifiable to ignore transfers or renamings based upon wholly inadequate citations. Many such transfers are now recognized wholly through courtesy.

VIRGINIA: edge of Lake Drummond, Dismal Swamp, October 2, 1921, *E. J. Grimes*, no. 4534 (TYPE in Gray Herb.), distributed and reported as *P. corymbifera* (C. Wright) Benth. by Grimes, RHODORA, xxiv. 148 (1922); pool in sandy barrens, Cape Henry, September 23, 1933, *Fernald & Griscom*, no. 2770.

Typical *Psilocarya scirpoides* (FIGS. 3 and 4) of southern New England (originally described from northeastern Rhode Island) has the nearly sessile spikelets blunter and more ellipsoid-ovoid, with slightly shorter, broader and less attenuate scales, its bracteoles herbaceous and strongly veined, with prominent green midrib. The achenes (FIG. 4) show no appreciable difference from those of var. *Grimesii* (FIG. 2). The more slender and mostly darker spikelets on longer pedicels were conspicuous in the field and the Virginia material is much larger than that of New England (and the Lake Michigan region); it thus strongly simulates *P. corymbifera* (C. Wright) Benth. of Cuba and Florida, for which the Grimes material was mistaken. The characteristic inflorescences of typical *P. scirpoides* (FIG. 3) and of var. *Grimesii* (FIG. 1) and achenes of both, as well as of the type of *P. corymbifera* (FIG. 6), are shown in PLATE 344.

The plant of Sussex Co., Delaware (wet soil, Baltimore Hundred, September 10, 1870, *Commons*), erroneously distributed as *P. nitens* (Vahl) Wood (FIG. 5), is slightly transitional but nearer the typical form of *P. scirpoides*.

ELEOCHARIS FLACCIDA (Reichenb.) Urban, var. **olivacea** (Torr.), comb. nov. *E. olivacea* Torr. Ann. Lyc. N. Y. iii. 300 (1836).

Collections made by ourselves, and other in 1934 by Fernald & Long, show that the characters (color of achene and length of bristles) relied upon to separate *E. olivacea* from the tropical and southern *E. flaccida* break down. The color of scales, likewise, is inconstant, though generally good. Specimens from tropical South America of typical *E. flaccida* sometimes have the bristles as long as in typical *E. olivacea* and the size and shape both of the tubercle and the achene shows too much inconstancy. *E. flaccida* in the South is chiefly in brackish habitats. North of southern New Jersey it is very local, chiefly in tidal estuaries: CONNECTICUT: border of marsh near New Haven, October 6, 1878, *J. A. Allen;* muddy shore, head of Hamburg Cove and muddy shore of Selden's Creek, Lyme, September 10 and 12, 1902, *Graves*. MAINE: Brunswick, August 6, 1894, *C. A. Davis;* tidal mud-flats of Cathance River, Bowdoinham, *Fernald & Long*, no. 12,783.

The best distinctions between the two varieties are the following.

E. flaccida (typical): Spikelets 2–6 mm. long; scales appressed, whitish-green to brown, the lowest 1.5–2.5 mm. long; tubercle with conic center 0.1–0.2 mm. high; bristles reaching to or overtopping achene.—Damp sands and sloughs, Florida to Texas, north on coast to tidal estuaries of New England; Yellowstone Park, Wyoming; Tropical America.

Var. olivacea. Spikelets 4–9 mm. long, more loosely flowered; scales loosely ascending, usually with brown or reddish sides, the lowest 2.3–2.8 mm. long; achenes with slightly prolonged base; tubercle with conic-subulate center 0.2–0.3 mm. high; bristles more often overtopping achene.—Wet sands and peats, Maryland to Nova Scotia; locally inland on wet peat, from Maine to southern Ontario and Minnesota, south to Pennsylvania, Ohio and Michigan.

Eleocharis obtusa (Willd.) Schultes, var. jejuna Fern. Virginia: wet marsh near North Landing River, Pungo Ferry, Princess Anne Co., *Fernald & Griscom*, no. 2777.

Var. *jejuna*, as recognized by Svenson in his revision, Rhodora, xxxi. 216 (1929), is not recorded from south of New England.

Scleria triglomerata Michx., var. gracilis Britton. Virginia: dry oak woods, Cape Henry, *Fernald & Griscom*, no. 2771.

Var. *gracilis* is a well marked extreme, apparently confined to the Coastal Plain, whereas the coarse typical form of the species has a wide continental range. Dr. Britton originally cited var. *gracilis* only from New Jersey, but it is now known from Long Island and from Virginia (see above), North Carolina (Wilson, Wilson Co., *Randolph*, no. 738) and Mississippi (Biloxi, *Tracy*, no. 4805).

Juncus biflorus Ell. Sk. Bot. S. Car. and Ga. i. 407 (1817). *J. marginatus* β. ? *odoratus* Torr. Fl. N. and Mid. U. S. 362 (1824). *J. heteranthos* Nutt. Trans. Am. Phil. Soc. n. s. v. 153 (1837). *J. odoratus* (Torr.) Steud. Syn. Pl. Glum. ii. 304 (1855). *J. marginatus* var. β. *biflorus* (Ell.) Wood, Class Bk., issue of 1861: 725; Engelm. Trans. St. Louis Acad. ii. 455 (1868) and in Gray, Man. ed. 5: 539 (1867); Buchenau, Engl. Bot. Jahrb. xii. 421 (1890). *J. marginatus aristulatus* Coville Proc. Biol. Soc. Wash. viii. 123 (1893) and later authors, as to plant, not as to type, *J. aristulatus* Michx. Fl. Bor.-Am. i. 193 (1803). *J. aristulatus* Bickn. Rhodora, vi. 174 (1904) and later authors, as to plant, not as to type.

In 1903 the senior author, examining the type of *Juncus aristulatus* Michx., made the memorandum: "small *J. marginatus*, with blunt petals and sharp sepals." Again, with Mr. Bayard Long, he re-examined the type in 1930 and they made a similar memorandum: "One bit of ordinary *J. marginatus* and 3 inflorescences 3–4.5 cm. long by 1–3 cm. broad, with erect branches and remotish 2–3-flowered glomerules; culms capillary, as slender as in small *J. macer*." Thus Michaux's type well agrees with his original description of *J. ari-*

stulatus, of which he said "Habitus *J. bulbosi*." Several recent collections from eastern North and South Carolina and Georgia agree with Michaux's material and are clearly depauperate *J. marginatus*.

The coarse plant with elongate and nodulose rhizome and solitary culms which has been recently passing as *J. aristulatus* is *J. biflorus* Ell. Most of the southern material has very open inflorescences with remote (1–) 2–3 (–6)-flowered glomerules; while many of the northern and some of the southern specimens have a compact inflorescence and approximate glomerules of 3–6 flowers. While these extremes seem to have no definite geographic localization, loose inflorescences sometimes occurring in the North and dense ones in the South, they are readily recognizable at a glance. Indeed it is surpising that two such striking extremes have no trenchant technical characters, and the situation recalls that in *Juncus macer*. We consequently propose the plant with dense inflorescences as a form, rather than a geographic variety.

JUNCUS BIFLORUS Ell., forma **adinus**, forma nova, inflorescentiis congestis, glomerulis approximatis.—TYPE: dry upper sandy and peaty beach of Saul's Pond, Brewster, MASSACHUSETTS, September 7, 1919, *Fernald* in Plant. Exsicc. Gray. no. 350 (in Gray Herb.).

(*To be continued.*)

THREE DAYS OF BOTANIZING IN SOUTHEASTERN VIRGINIA

M. L. Fernald and Ludlow Griscom

(*Continued from page 157*)

Laportea canadensis (L.) Gaudich. Virginia: ditch at border of gum swamp south of North Landing, Norfolk Co., no. 2871.

Not represented in the Gray Herbarium from the coastal plain south of New York.

Polygonum arifolium L., var. **lentiforme**, var. nov., a forma typica recedit achaeniis minoribus lenticularibusque vix gibbosis 3–3.5 mm. latis 2.2–2.6 mm. crassis.—Prince Edward Island to southern Ontario, south to New Jersey, Pennsylvania, Ohio and Michigan. Type: swamp along Great Brook, Southwick, Massachusetts, *F. C. Seymour*, no. 251 (in Gray Herb.).

The common *Polygonum arifolium* of southeastern Canada and the northeastern States has the achene very definitely smaller than in the more southeastern plant. All material in fruit from the District of Columbia southward has the achenes 4–4.2 mm. broad and 3–3.2 mm. thick, with noticeably more umbonate sides. In view of the original Linnean citation of the species as coming from "Virginia, Florida," the southern plant must stand as typical *P. arifolium*.

Lespedeza acuticarpa Mackenz. & Bush. Virginia: dry border of gum swamp, Pungo Causeway, near Land of Promise, Princess Anne Co., no. 2838.

Our material is a close match for several sheets of the Missouri plant distributed by Bush. It is apparently the first from the Atlantic slope.

Variations of Rhus copallina.—The shrub and small tree of southeastern Virginia impressed us, as it did later Fernald and Long, by the numerous pairs of narrow leaflets, as contrasted with the fewer and broader leaflets of the northern and wide-ranging shrub. Linnaeus, in publishing the species, rested it upon earlier citations, one of them a specimen of Clayton's (no. 728, described by Gronovius), the other a very conventionalized and barely recognizable figure of Plukenet's. The Clayton plant, having been definitely studied by Linnaeus, should be accepted as the type. Thanks to a life-sized tracing of the type, kindly supplied by Professor H. W. Rickett, who recently spent some time at the British Museum, we are now able to identify *R. copallina* as the small tree of the southeastern United States (south into Florida) with the lance-oblong leaflets definitely attenuate at base. This typical *R. copallina* extends locally along the coast to southeastern New York.

The more generally distributed variation, common from southern Maine to Michigan, southward into the upland of North Carolina and to Oklahoma, has the comparatively few leaflets more ovate-lanceolate or short-oblong and rounded at the base. This is var. *latifolia* Engler in DC. Mon. iv. 384 (1883).

In the Southwest, especially in Texas, the leaflets are lance-falcate, smaller and narrower than in typical *R. copallina*. This is var. *lanceolata* Gray, Journ. Bost. Soc. Nat. Hist. vi. 158 (1850).

In southern Florida the species is represented by var. *leucantha* (Jacq.) DC. Prod. ii. 68 (1825). This was based upon *R. leucantha* Jacq. Hort. Schoenb. iii. 50. t. 342 (1798). *R. leucantha* was a cultivated shrub of unknown origin. By Small it is restricted to the West Indies and the Everglade Keys of Florida. Apparently the only collection from the West Indies is *C. Wright*, no. 2290 from Cuba, first recorded by Grisebach as *R. copallina*, var. and cited by Engler (along with a Rugel specimen from Portsmouth, Virginia which is true *R. copallina*) as the basis of his *R. copallina*, var. *angustialata* Engler, l. c. Engler cited *R. leucantha* as a direct synonym of this variety. Wright's original field-label on the sheet in the Gray Herbarium states that it was CULTIVATED at Pinales Rangel, Sabanilla. Its source in Cuba is perhaps as vague as that of the Jacquin type.

Another variation in Florida, thence north to South Carolina is

Var. **obtusifolia** (Small), comb. nov. *Schmaltzia obtusifolia* Small, Fl. Se. U. S. 729 (1903). *R. obtusifolia* Small, Fl. Miami, 112 (1913).

THE VARIATIONS OF ROTALA RAMOSIOR (PLATE 345).—*Rotala ramosior* (L.) Koehne occurs in two very distinct varieties: one with small fruits and minute subulate bractlets, chiefly on sandy shores of the Atlantic coastal plain northward to Massachusetts, with remote areas on the sands of the Great Lakes and on the Pacific slope; the other, coarser throughout, with conspicuously larger fruits and elongate, linear-lanceolate bractlets. The latter occurs in rich low grounds from the Hudson Valley to Iowa and southward; both varieties occurring in Virginia, the source of the Clayton type. *Ammania ramosior* L., upon which *R. ramosior* was based, rested wholly on the Clayton (Gronovian) plant, no. 774. This has been carefully compared by the junior author with characteristic specimens of the two extremes. The type is clearly a large plant of the coastal plain extreme, with the smaller leaves, and the abundant fruit never wider than in the largest of a characteristic Florida sheet and none quite as long. The larger, chiefly inland variety should, therefore, be called

ROTALA RAMOSIOR (L.) Koehne, var. **interior** (TAB. 345, FIGS. 1 et 2), planta robusta ad 4.5 dm. alta simplex vel plerumque ramosa, ramibus adscendentibus; foliis majoribus 5–10 mm. latis subsessilibus vel breve petiolatis; fructibus (3.2–) 3.8–4.4 mm. latis 3.5–5 mm. longis; bracteolis lineari-lanceolatis, 1.6–2.4 (–4) mm. longis.—Rich low ground, Hudson Valley, New York to Iowa, south to Florida, Louisiana and Oklahoma. TYPE: low wet grounds, Knox Co., TENNESSEE, July 21, 1890, *Albert Ruth*, no. 224 (in Gray Herb.).

Contrasted with var. *interior*, typical *Rotala ramosior* is distinguished as follows:

R. RAMOSIOR, var. **typica** (PL. 345, FIG. 4 and 3, transitional). *Ammania ramosior* L. Sp. Pl. 120 (1753). *A. ramosa* Hill, Veg. Syst. xi. 14 (1767). *A. humilis* Michx. Fl. Bor.-Am. i. 99 (1803). *A. auriculata* Raf. Atl. Journ. 146 (1832). *Boykinia humilis* Raf. Aut. Bot. 9 (1840). *A. occidentalis*, var. *pygmaea* Chapm. Fl. So. U. S. 134 (1860). *R. ramosior* (L.) Koehne in Mart. Fl. Bras. xiii.[2] 194 (1875). Plant low, simple to diffusely branched or depressed, rarely 2 dm. high: larger leaves 1.5–4 (–5) mm. broad, longer-petioled: fruit smaller, 2–3.3 mm. broad, 2–4 mm. long; bractlets subulate, 0.5–1.4 mm. long.—Sandy pond-shores, etc., coastal plain from Massachusetts to Florida and Texas; sands of southern Michigan, northern Indiana, Illinois and Minnesota; also Washington and Oregon.

Rafinesque, Aut. Bot. 39 (1840) gave names to "4 sp. or var. blended in *A. ramosa*" but his diagnoses, based merely on habit rather than more fundamental characters, are not clearly decipherable.

RHEXIA IN NORTHEASTERN AMERICA (PLATES 346 and 347).—In the area covered by Gray's Manual and Britton's Manual five species of *Rhexia* have been recognized: *R. virginica* L. (PL. 347, FIGS. 1–4, and PL. 346, FIG. 5), widespread from Nova Scotia southward and westward; *R. mariana* L. (PL. 347, FIGS. 5 and 6, and PL. 346, FIG. 7), from Florida north to southeastern Massachusetts, and reputed to grow in the interior; *R. interior* Pennell (PL. 346, FIG. 6 and PL. 347, FIG. 7), somewhat related to the two preceding; *R. aristosa* Britton (PL. 347, FIG. 8), an exceedingly local species of the coastal plain from Georgia to New Jersey; and *R. ciliosa* Michx., a characteristic species of the southern pine barrens, which in Torrey and Gray's Flora of North America (1840) was recorded with doubt from Delaware and which has lingered in our manuals since the first edition (1848) of Gray, as growing in Maryland. No material of the latter is in the Gray Herbarium from north of North Carolina and the species was not admitted by Shreve to the flora of Maryland. It should be dropped from northern floras until there is definite evidence of it north of the Carolinas.

Field experience in southeastern Virginia failed to reveal any *Rhexia aristosa;* but it was evident that the abundant material of *Rhexia* there could not be referred merely to the two Linnean species. In fact, we and, in 1934 Fernald and Long found no true *R. mariana* and the only *R. virginica* found was a very local area in 1934. The identification of our material has, therefore, led to a consideration of the entire genus. We are here presenting our conclusions regarding it within the "Manual range."

The subterranean habit is fundamental but all too rarely well displayed in herbarium specimens; the size and distribution of murications or processes on the seeds are apparently constant characters; so, too, is the relative length of the neck of the hypanthium. The two former characters are practically never mentioned in current treatments. Pubescence, breadth of leaf and color of flowers in our section of the genus are secondary.

The brilliantly reflecting or iridescent lustre of the seeds makes them difficult to bring out properly by photography. Consequently, Miss Ruth Peabody, of Radcliffe College, has kindly supplied us with drawings, × 50, of the seeds needed in clarifying the more northern species of the genus. The photographs show, besides the newly proposed species, the characteristic bases of *Rhexia virginica* (pl. 347, figs. 9–11), and of *R. mariana* (pl. 347, fig. 13), and, × 4, fruiting hypanthia of each of our species.

a. Leaves entire or only remotely serrate: calyx-lobes longer than neck of hypanthium; bristles of hypanthium not gland-tipped; petals aristate at apex: stem glabrous. . . . . .1. *R. aristosa.*

a. Leaves regularly serrulate: calyx-lobes shorter than to about equaling neck of hypanthium; bristles of hypanthium (when present) gland-tipped: petals not aristate-tipped: stems often more or less pubescent. . . .*b.*

b. Tuberous rooted, the bases not forming horizontal, subligneous runners: seeds 0.65–0.8 mm. long. . . . . .2. *R. virginica.*

b. Non-tuberous, the bases consisting of tap-roots and horizontally spreading or creeping subligneous stolon-like stems: seeds 0.5–0.6 mm. long.

Neck of fruiting hypanthium longer than body: stems subterete, not obviously 4-angled..................3. *R. mariana.*
Neck of fruiting hypanthium as long as or shorter than body: stems 4-angled, especially above.
Mature hypanthium (excluding calyx-lobes) 7.5–10 mm. long, its body 4–5 mm. in diameter: seeds with low rounded pebbling, the surface appearing relatively uniform..................................4. *R. interior.*
Mature hypanthium 9–14 mm. long, its body 5.5–8 mm. in diameter: seeds with prominent thin ridges and slender papillae.........................5. *R. ventricosa.*

1. R. ARISTOSA Britton, Bull. Torr. Bot. Cl. xvii. 14, t. 99. (1890).—Very locally in pine barrens, New Jersey to Georgia. PLATE 347, FIG. 8.

2. R. VIRGINICA L. Sp. Pl. 346 (1753).—Georgia to Louisiana, north to Nova Scotia and locally inland to central and western New York, southern Ontario, Ohio, Indiana, Wisconsin and Missouri. Type studied by junior author. PLATE 347, FIGS. 1–4, PL. 346, FIG. 5.

In *Rhexia virginica* the hypanthium has the neck very much shorter than the body and the very papillose seeds are the largest in this section. The pubescence is very variable, some plants from as far north as Nova Scotia being as glabrous as the southern *R. stricta* Pursh, which has the seeds as small as in *R. mariana.* The base, when properly collected, is absolutely distinctive. PLATE 347, FIG. 1 shows a tuber, × 1, from a gravelly shore, FIG. 2 from moss, FIG. 3 from inundated peat.

3. R. MARIANA L. A somewhat polymorphic species, clearly distinguished among those with horizontally spreading subligneous bases (PLATE 347, FIG. 5), by its terete or subterete stems and the long necks of the fruiting hypanthiums. We recognize three varieties:

Var. **typica**. *R. mariana* L. Sp. Pl. i. 346 (1753). *R. mariana,* var. β. *rubella* Michx. Fl. Bor.-Am. i. 221 (1803).—Leaves lanceolate to elliptic, subglabrous to hirsute: petals pale-rose to whitish, 1.2–2 cm. long; seeds rather sharply muriculate.—Florida, northward on the coastal plain to Cape Cod, Massachusetts. Type examined by junior author. PLATE 346, FIG. 7.

Var. PURPUREA Michx. Fl. Bor.-Am. i. 221 (1803). *R. Nashii* Small, Fl. Se. U. S. 824, 1335 (1903).—Rather coarser throughout: leaves lanceolate, more generally villous-hirsute: petals deep-rose-color or purple, 1.5–2.5 cm. long: seeds with conspicuous pebbling.—Louisiana to Florida, north on the coastal plain to southeastern VIRGINIA: about Franklin, Southampton Co., *Heller,* no. 1115; Northwest, Norfolk Co., *Heller,* no. 727; wet peaty clearings in woods of *Pinus serotina,* south of Grassfield, Norfolk Co., *Fernald & Long,* no. 4065; shallow pools and wet peaty depressions in pineland, Cape Henry, *Fernald & Griscom,* no. 2859, *Fernald & Long* no. 4061; inundated swales back of dunes, south of False Cape, Princess Anne Co., *Fernald & Long,* no. 4067. PLATE 346, FIGS. 5 and 6.

Var. **leiosperma**, var. nov. (TAB. 346, FIG. 8), a var. *typica* recedit seminibus obsolete muriculatis, papillis depressis.—Louisiana and

Texas northward to Missouri, southern Illinois and southern Indiana. The following are referred here. INDIANA: sandy soil 2 miles west of Grand View, Spencer County, *Deam*, no. 16,654. ILLINOIS: wet grassy places, Metropolis, August 16, 1902, *Gleason*. KENTUCKY: Monkey's Eyebrow, Ballard Co., August 14, 1928, *W. A. Anderson*. TENNESSEE: open grassy swamp, Hollow Rock Junction, Carroll Co., *Svenson*, no. 419; gravelly oak woods, 6 miles east of Crossville, alt. 2300 feet, *Svenson*, no. 4146. MISSOURI: Dunklin Co. *Bush*, no. 42. ARKANSAS: Pulaski Heights, Little Rock, *Demaree*, no. 8128; Little Rock, June 21, 1885, *W. H. Manning*. LOUISIANA: meadows, near Alexandria, *Ball*, no. 618. TEXAS: Houston, May, 1883, *Lindheimer*; eastern Texas, *E. Hall*, no. 198; damp sandy soil, Montgomery Co., July 18–21, 1909, *R. A. Dixon*, no. 487 (TYPE in Gray Herb.); near Texarkana, Barrie Co., *Heller & Heller*, no. 4143.

Var. *leiosperma* has a range covering that of *Rhexia interior*. The latter species, however, has quadrangular stems, broader, round-based and essentially sessile leaves suggesting those of *R. virginica*, short neck of hypanthium and coarser seeds with more obvious pebbling.

4. R. INTERIOR Pennell, Bull. Torr. Bot. Cl. xl. 480 (1918), renaming of *R. latifolia* Bush, RHODORA xiii. 167 (1911), not Aubl. (1775).—Pond-shores, wet ground and prairies, Missouri. PLATE 346, FIG. 6, and PL. 347, FIG. 7.

5. R. **ventricosa**, n. sp. (TAB. 346, FIGS. 1–4), planta etuberifera, radice verticaliter descendente caulibus subligniis stoloniformibusque horizontaliter reptantibus; caulibus floriferis quadrangulatis 2.5–8 dm. altis plus minusve hispidis laxe ramosis ramis adscendentibus; foliis elliptico-lanceolatis vel anguste oblongo-ovatis sessilibus vel subsessilibus 2–6 cm. longis 0.7–2.3 cm. latis valde 3-costatis hispidis; hypanthiis plus minusve glanduloso-setosis maturis 9–14 mm. longis, basi ventricosis 5.5–8 mm. diametro in collum subaequantium productо; lobis calycis deltoideo-lanceolatis 2–3 mm. longis divergentibus; petalis purpureis 1.5–2 cm. longis; antheris flavis 8–9 mm. longis angustis basi appendiculatis, appendiculis 1–2 mm. longis; seminibus cochleiformibus 0.5–0.6 mm. longis longitudinaliter angusteque costatis, costis valde papillosis, papillis angustis subremotis.—Southeastern Virginia and eastern North Carolina. VIRGINIA: vicinity of Norfolk, September, 1906, *M. C. Jansen*, as *R. virginica*; border of gum swamp, Pungo Causeway near Land of Promise, Princess Anne Co., *Fernald & Griscom*, no. 2856; dry clay of open woods and thickets, north of Blackwater River, Princess Anne County, *Fernald & Long*, no. 4066; open clay at border of woods, east of Little Creek, Princess Anne County, July 31, 1934, *Fernald & Long*, no. 4064 (TYPE in Gray Herb.); wet roadside ditch near Princess Anne Courthouse, *Fernald & Griscom*, no. 2857; wet meadow near Pungo, Princess Anne County, *Fernald & Griscom*, no. 2858. NORTH CAROLINA: grassy roadside bank, 8 miles south of Williamstown, Martin Co., *Wiegand & Manning*, no. 2146, as *R. mariana*: open dry sandy field, 6 miles west of Greenville, Pitt Co., *Wiegand & Manning*, no. 2148 (mixed with *R. mariana*).

Rhexia ventricosa superficially looks somewhat intermediate between *R. mariana* and *R. virginica*, but has a root system unlike either, a deep tap-root as in *R. virginica* but without the tubers which characterize that species, and horizontally spreading substoloniform branches (which occasionally develop slender stolons). Its stems are obviously square in section, but without the wing-angles of well developed *R. virginica* and the pubescence is sparser than in *R. mariana*. The leaves are somewhat intermediate in shape but without the distinct petiole and the well developed axillary fascicles of *R. mariana*. The flowers and fruits are nearly as in *R. mariana*, var. *purpurea* (*R. Nashii*) but the neck of the hypanthium is relatively short, and the calyx-lobes are nearly as long as the neck. The seeds lack a well developed dorsal crest and, under magnification, appear falsely alveolate from the deep shadows between the distinct or evenly spaced papillae.

The tendency of *Rhexia ventricosa* to prefer dryish or merely damp clay will be noted in the citation of specimens. In Princess Anne County we saw no *R. virginica*, though Fernald and Long got it in wet peat in a piece of pine barren in Norfolk Co., in 1934; and in both Princess Anne and Norfolk Counties *R. mariana*, var. *typica* seems to be wanting, its place there being taken by the southern var. *purpurea* (*R. Nashii*).

Rhexia ventricosa is, apparently, nearly related to *R. interior* Pennell: but it has a much larger hypanthium, with the ventricose body of greater diameter (whence the name), the calyx-lobes much larger and the papillae of the seeds slenderly columnar (in *R. interior* low and dome-like).

The Variations of Ludwigia sphaerocarpa (Plate 348). As currently interpreted *Ludwigia sphaerocarpa* Ell. Sk. Fl. S. C. and Ga. i. 213 (1821), of the southeastern coastal plain, extends northward to eastern Massachusetts and reappears in the isolated area of coastal plain types in northern Indiana. Our collection from Cape Henry, however, departs so definitely from the typical plant described by Elliott and, at the same time, is so unlike the plant with which we are familiar in Massachusetts, that it has seemed desirable to study the series with care. We find that the species breaks very naturally into four geographic trends.

Rameal leaves strongly reduced, glabrous or pubescent, lanceolate.
- Mature hypanthium small, 2.5–3.2 mm. long by 2.8–4 mm. broad, averaging broader than long.
  - Hypanthium only pubescent: glabrous leaves narrowly linear-lanceolate and attenuate. . . . . .Var. *typica*.
  - Hypanthium, branches and leaves pubescent: leaves more broadly lanceolate, not attenuate. . . . . .Var. *jungens*.
- Mature hypanthium larger, 3.5–4.6 mm. long, 3.2–4 mm. broad, averaging longer than broad. . . . . .Var. *macrocarpa*.

Rameal leaves scarcely smaller than the primary ones, pubescent, narrowly oblong: stems pubescent: hypanthium pubescent, 3 mm. long, about as wide . . . . Var. *Deamii.*

Var. **typica** (FIGS. 1 and 2). *L. sphaerocarpa* Ell. l. c. (1821).—Coastal plain, from Louisiana to Florida, north to North Carolina, rarely to Rhode Island. The following northern specimens have been seen: NEW JERSEY: Bennett, Cape May Co., August 29, 1922, *J. M. Fogg, jr.*, no. 359. NEW YORK: Southampton, Long Island, *St. John*, no. 2829. RHODE ISLAND: Worden's Pond, South Kingstown, Washington Co., August 16, 1930, *Anderson, Collins, Lownes & Weatherby.*

In var. *typica* the flowers are mostly remote on the elongate branches; the "*Leaves* 2 inches long, 2 lines wide, very acute, base also acute, glabrous"—Elliott.

Var. **jungens,** var. nov. (FIGS. 3 et 4), var. *typicae* simillima a qua differt ramis foliisque pubescentibus, foliis lanceolatis vix attenuatis.—Southeastern Virginia to southern New Jersey and eastern Pennsylvania. VIRGINIA: pool in sandy barrens, Cape Henry, September 23, 1933, *Fernald & Griscom*, no. 2862 (TYPE in Gray Herb., isotype in herb. Griscom; growing dominantly in pool with *Psilocarya scirpoides*, var. *Grimesii*—see p. 00). DELAWARE: Ellendale, September 1, 1892, *A. Commons* (mixed with *L. linearis*). PENNSYLVANIA: Bristol, *E. Diffenbaugh.* NEW JERSEY: Cold Spring, Cape May Co., *Gershoy*, no. 504; Hammonton, Atlantic Co., 1882, *F. L. Bassett*, and 1917, *Gershoy*, no. 505.

Var. **macrocarpa,** var. nov. (FIGS. 5 et 6), var. *typicae* simillima a qua differt foliis glabris latioribus lanceolatis acutis vix attenuatis; floribus plerumque approximatis vel subapproximatis; fructibus 3.5–4.6 mm. longis, 3.2–4 mm. latis.—New Jersey to southeastern New York and eastern Massachusetts. Seen from the following localities: NEW JERSEY: Quaker Bridge, Atlantic Co., September, 1867, *C. F. Parker;* Delanco, Burlington Co., *Hermann*, no. 3638. NEW YORK: Staten Island, September, 1879, *N. L. Britton;* Manor, Long Island, 1871, *E. S. Miller;* Peekskill, Westchester Co., *Browne;* Lake Mohegan, July 24, 1887, *J. W. Martens, jr.* CONNECTICUT: West Pond, North Guilford, numerous collections; Killingworth, *E. H. Eames*, no. 11,046. RHODE ISLAND: Cranston, Providence Co., August, 1907, *Thos. Hope.* MASSACHUSETTS: Fall River, August 15, 1913, *Sanford;* Lakeville, Plymouth Co., numerous collections (TYPE: stony shore of Quitacas Pond, Lakeville, August 27, 1899, *W. P. Rich* in Gray Herb.); Upper Waltham Pond, near Prospect Hill (locality probably destroyed), *Asa Gray;* common in Concord River from Bedford to Billerica, numerous collections.

Var. **Deamii,** var. nov. (FIGS. 7 et 8), ramis foliis fructibusque pubescentibus; foliis anguste oblongis, longioribus vix 4 cm. longis obtusiusculis, foliis ramulorum vix reductis; fructibus 3 mm. longis, 3 mm. latis.—INDIANA: low border of Lake Walker, northwest of

Baileytown, Porter Co., August 23, 1925, *C. C. Deam*, no. 42,350 (TYPE in Gray Herb.).

NOTES ON LUDWIGIA, § ISNARDIA (PLATE 349). In studying our material it became apparent that this section of *Ludwigia* was in need of revision. In the latest treatment, in Small's Manual, four species of *Isnardia* are recognized, based primarily on the length of the capsule. Concerning *L. spathulata* T. & G. we have nothing to add; it seems to be a unique species.

Another well known southern species is *Ludwigia natans* Ell. or *Isnardia natans* (Ell.) Kuntze. This now appears as *I. repens* (Sw.) DC., based on *L. repens* Sw. Fl. Ind. Occ. i. 273, t. 8 (1797), a name preoccupied by one of the North American representatives of *L. palustris* (L.) Ell., which was first recognized as differing from the European type as *L. repens* Forst. Cat. Pl. N. Am. 22 (1771). There prove to be two strong tendencies of *L. natans* in the southeastern United States and a third isolated in southern California. These are characterized in the following key.

Mature fruit (excluding calyx-lobes) 4–5.6 (–6) mm. long. *L. natans*, var. *typica*.
Mature fruit 6–10 mm. long, usually more tapering at base.
  Fruit sessile or subsessile. . . . . Var. *rotundata*.
  Fruit on distinct pedicels up to 4 mm. long. . . . . .Var. *stipitata*.

L. NATANS Ell., var. **typica**. *L. natans* Ell. Sk. Bot. S. C. and Ga. i. 581 (1821). *Isnardia natans* (Ell.) Ktze. Rev. Gen. i. 251 (1891). *I. intermedia* Small & Alexander in Small, Man. Fl. Se. U. S. 940 or *I. media* Small & Alexander, l. c. 1506 (1933), illegitimate names under the International Rules as adopted at Cambridge until validated by a Latin diagnosis.—Florida to Texas, north, locally, to North Carolina, Tennessee and Missouri; also Bermuda. FIG. 2, fruit, × 4.

Var. **rotundata** (Griseb.), comb. nov. *Isnardia repens*, var. *rotundata* Griseb. Cat. Pl. Cub. 107 (1866). *L. repens* Sw. Fl. Ind. Occ. i. 273, t. 8 (1797), not Forst. (1771). *I. repens* (Sw.) DC. Prodr. iii. 60 (1828). *L. fluitans* Scheele, Linnaea, xxi. 580 (1848). *L. repens*, β. *rotundata* (Griseb.) Gomez, Anal. Hist. Nat. Madrid, xxiii. 66 (1894). FIG. 3, fruit, × 4.

The Grisebach type was the rather unusual aquatic state of the long-fruited variety with dilated leaves, whereas most specimens in the herbaria are of the terrestrial state, with narrower and firmer leaves. The variety occurs in Mexico, the Greater Antilles, Bermuda, and from Georgia and Florida to Texas.

Var. **stipitata**, var. nov. (FIGS. 1 et 4), var. *rotundifoliae* simillima a qua differt floribus fructibusque pedicellatis, pedicellis usque ad 4 mm. longis.—CALIFORNIA: San Bernardino, August, 1881, *S. B. & W. F. Parish*, no. 682 (TYPE in Gray Herb.); other collections from the same region by *Parish Bros.* and by *G. R. Vasey.* Fig. 1, node, × 1; fig. 2, flower, × 4.

Ludwigia natans is most readily distinguished from the somewhat smaller *L. palustris* by its lacking the 4 longitudinal green bands on the hypanthium and by often having in their place 1 or more free or partly free long and narrow bractlets borne well above the base, the very short bractlet of *L. palustris,* when present, being basal.

There prove to be at least four strongly developed geographic trends in *Ludwigia palustris,* the typical Linnean plant being essentially European (extending slightly into western Asia and northern Africa). The four varieties may be distinguished as follows:

Longitudinal green bands of the hypanthium terminating well below the sinuses; body of fruit whitish and corky, 4–5.3 mm. long . . . . . Var. *typica.*
Longitudinal green bands extending nearly or quite to the sinuses; body of the darker and less corky fruit 2–4.5 mm. long.
  Mature hypanthium 2 (rarely 1.8)–3.5 mm. in diameter at the middle; calyx-lobes broadly deltoid.
    Leaf-blades of terrestrial state long-petioled, subacute to short-pointed, broad: calyx-lobes scarcely acuminate . . . Var. *americana.*
    Leaf-blades of terrestrial state short-petioled, usually acuminate and narrower: calyx-lobes acuminate . . . . . Var. *pacifica.*
  Mature hypanthium 1.4–2 mm. in diameter at the middle; calyx-lobes narrowly deltoid to broadly lanceolate, acuminate: leaves long-petioled . . . . . Var. *nana.*

L. palustris (L.) Ell., var. **typica.** *Isnardia palustris* L. Sp. Pl. 175 (1753). *L. palustris* (L.) Ell. Sk. Fl. S. C. and Ga. 211 (1821), as to name-bringing synonym.—Europe and adjacent Asia and Africa. Fig. 7, fruit, × 4.

Var. **americana** (DC.), comb. nov. *Isnardia palustris,* β. *americana* DC. Prodr. iii. 61 (1828). *L. repens* Forst. Cat. Pl. N. Am. 22 (1771), not Sw. (1797). *L. apetala* Walt. Fl. Carol. 89 (1788). *L. nitida* Michx. Fl. Bor.-Am. i. 87 (1803). *I. ascendens* Hall in Eat. & Wr. N. Am. Bot. 285 (1840). *L. palustris,* var. *Liebmanni* Lévl. Bull. Geogr. Bot. xxii. 24 (1912).—Nova Scotia, New Brunswick and southern Quebec to Minnesota, south to Georgia, Louisiana and Texas; eastern Washington, eastern Oregon and northeastern California to Guatemala; also Bermuda. Fig. 8, fruit, × 4.

Var. **pacifica,** var. nov. (figs. 5 et 9), var. *americanae* simillima a qua differt foliis angustioribus lanceolatis vel anguste ellipticis, apice attenuatis breviter petiolatis; fructibus 2.8–3.4 mm. longis, 2.2–2.8 mm. latis, lobis calycis anguste deltoideis acuminatis.—Pacific Coast from Vancouver Island and western Washington to California. Type: gravelly shore, Sproat Lake, Vancouver Island, July 14, 1914, *W. R. Carter,* no. 128 (in Gray Herb.). Fig. 5, small plant of type collection, × 1; fig. 9, fruit, × 4.

Var. **nana,** var. nov. (figs. 6 et 10), var. *americanae* simillima a qua differt laminis foliorum longe petiolatis minoribus rare 2.5 cm. longis;

fructibus 2.2–3 mm. longis 1.4–2 mm. latis, lobis calycis anguste deltoideis vel late lanceolatis acuminatis.—Southern Georgia and Florida along the Gulf to Texas; also Cuba, Haiti, southeastern Mexico and Columbia. TYPE: Cameron, LOUISIANA, July 5, 1903, *S. M. Tracy*, no. 8718 (in Gray Herb.). FIG. 6, fruiting branch, × 1; FIG. 10, fruit, × 4.

Var. *nana* in its small fruits and leaves is the greatest departure from typical *L. palustris*. Whereas the foliage of the terrestrial and aquatic states is very different in the other varieties, the two states are barely distinguishable in var. *nana*.

PROSERPINACA PALUSTRIS AND ITS VARIETIES.—The plant of southeastern Virginia impressed us as somewhat unlike the more familiar variation in the North. This impression was due to the large, broad-faced and very thin-angled fruits, whereas the plant of wide range, from Nova Scotia to Wisconsin, south to the interior of Georgia and Oklahoma has smaller and more elongate fruits 2.3–4 mm. broad, with merely subacute angles, while an extreme variation of the interior, var. *amblyogona* Fern. RHODORA, xi. 120 (1909), has the angles strongly rounded or almost obsolete.

The plant with broad and thin-angled concave-sided fruits 4–6 mm. broad has been called *P. palustris*, var. *latifolia* Schindler in Engler, Pflanzenr. iv^{225}. 76 (1905); also *P. platycarpa* Small, Bull. N. Y. Bot. Gard. iii. 432 (1905). Var. *amblyogona* has also been taken up as a species, *P. amblyogona* (Fern.) Small, Man. Se. Fl. 954 (1933). In their vegetative characters there are no constant differences and the fruits show many transitions. Geographically, many of the plants of the coastal plain area from New Jersey to Nova Scotia are clearly transitional between the commoner northern variation and that of the Southeast. Similarly in the interior, it is sometimes difficult to recognize var. *amblyogona*.

Most unfortunately, a study of the type in the Linnean herbarium, the material described as *Proserpinaca palustris* L. Sp. Pl. 88 (1753), proves it to be the southeastern broad-fruited extreme, the plant called by Schindler var. *latifolia*, by Small *P. platycarpa*. Five ripe fruits remained (1934) on the type and two of these are actually a little larger than the largest fruit on a reference sheet from Cape May, New Jersey. It, accordingly, becomes necessary to characterize the common northern plant as

PROSERPINACA PALUSTRIS L., var. **crebra**, var. nov., fructibus minoribus 2.3–4 mm. latis, angulis subacutis nec alatis.—Nova Scotia to Wisconsin, south to Georgia and Oklahoma. TYPE:

Hampton, New Hampshire, August 31, 1902, *E. F. Williams* (in Gray Herb.).

Ipomoea hederacea (L.) Jacq., var. integriuscula Gray. Virginia: roadside bank, Back Bay, Princess Anne Co., no. 2877.

Cited by Small under *Pharbitis barbigera* (Sims) G. Don, only north to Georgia. The fresh flowers were bright azure-blue; in the dried material they have faded to reddish-pink.

Lippia lanceolata Michaux. Michaux described *L. lanceolata* "foliis lineari-lanceolatis" from the Ashley River, South Carolina. Nevertheless, the species, given a broad inland range, was described by Gray with leaves "varying from obovate and lanceolate-spatulate to ovate" and with the special comment "name therefore inapt." Gray's impression was due to the fact that in his day there was no material in the Gray Herbarium (at least) of the narrower-leaved plant which Michaux had accurately described (plate 350, fig. 1). We now know the narrow-leaved extreme as a plant of the outer coastal plain, from Cape May, New Jersey to South Carolina and Louisiana. The wide-ranging broad-leaved extreme seems to have no available name and we, therefore, call it

Lippia lanceolata Michx., var. **recognita,** var. nov. (tab. 350, fig. 2), foliis obovatis vel late lanceolato-spathulatis vel anguste ovatis.—Type: swampy places, Fremont Co., Iowa, July 30, 1898, *T. J. Fitzpatrick* in Gray Herb. Eastern Pennsylvania to southern Ontario, Iowa and Nebraska, south to Florida, Louisiana, Texas and adjacent Mexico.

Physalis maritima M. A. Curtis. Virginia: sand hills, Cape Henry, no. 2885.

Physalis maritima is the maritime plant, with elliptic or oblong and obtuse stellate-puberulent leaves attenuate to the short petiole, which is included in the North American treatments under *P. viscosa* L. The latter species was based, however, both by Linnaeus and Gronovius (before him) on a plant described and excellently illustrated by Dillenius from Buenos Aires, with cordate leaves. Abundant material from Argentina and adjacent countries well represents *P. viscosa*, which has nothing to do with the plant of coastal sands of our southeastern states.

The ascription of *Physalis viscosa* of American authors to "Virginia" goes back to Gronovius, who, obviously, had something else in hand.

Galium tinctorium L., var. floridanum Wieg. Virginia: brackish marsh, Pungo Ferry, Princess Anne Co., no. 2890.

Although Wiegand cited this variety only from Florida, our material is a perfect match for the type-collection.

Eupatorium cuneifolium Willd., var. **semiserratum** (DC.), comb. nov. *E. semiserratum* DC. Prodr. v. 177 (1836).

We are unable to find any characters in the involucres, corollas and achenes by which to keep *E. semiserratum* specifically apart from *E. cuneifolium.* The extreme difference in leaf-outline and degree of toothing is marked but many transitional specimens occur.

Eupatorium rotundifolium and Allies. Long field experience with *Eupatorium rotundifolium* and the plants associated with it as related species, in many parts of their range, has convinced us that extensive modification of the present specific concept is necessary, if we are to interpret correctly the highly variable mass of material. As currently treated, the series *Rotundifoliae* consists of *E. sessilifolium* L., a glabrous plant with obtuse or obtusish involucral bracts and very long-acuminate, finely serrate leaves with strongly rounded to truncate, closely sessile bases; and, set off from this usually clear-cut species, another group, *E. rotundifolium* L., *E. pubescens* Muhl., *E. scabridum* Ell. and *E. verbenaefolium* Michx., characterized by acute to attenuate inner bracts and shorter, thicker and pubescent blunt or merely acute leaves, with coarser and blunter toothing. These four prove to be bewilderingly variable in shape, size and toothing of the leaves; and search for more stable characters has led us to the conclusion that the treatment of Asa Gray in the Synoptical Flora was correct, *E. scabridum* and *E. pubescens* being reduced to varietal rank under *E. rotundifolium.* We should go further and unite with them *E. verbenaefolium* of current treatments (*E. teucrifolium* of the Synoptical Flora). *E. sessilifolium* has the tube of the corolla nearly equaling the throat (as in *E. hyssopifolium*), while all the others agree in having the tube much shorter than the throat. In every other character extreme specimens in both groups definitely converge.

Eupatorium sessilifolium is primarily a species of rich or calcareous areas and is unknown on the typical sandy and acid soils of the coastal plain, where the others are dominant. It is ordinarily very distinct from the other four, separated by the characters noted above; but from Maryland and the District of Columbia inland to the mountains of Virginia, West Virginia and Tennessee a remarkable extreme is dominant, which entirely lacks the characters conventionally ascribed to the species, except in having the corolla of *E. sessilifolium.* The stem of this plant is densely cinereous-puberulent; both surfaces of the leaves are often similarly and densely puberulent; and the leaves are shorter, broadly ovate to ovate-lanceolate and acute, but never with the long acumination characteristic of typical glabrous *E. sessilifolium.* This plant, has consequently, been distributed by collectors either as *E. sessilifolium ?*, *E. pubescens* or a hybrid of the two; and it was described as *E. Vaseyi* by Porter, Bull. Torr. Bot. Cl. xix. 128 (1892). Having the distinctive corolla of *E. sessilifolium*, this plant is evidently a well defined variety of that species. The type, from Lookout Mt., Tennessee, kindly loaned by Dr. Maxon to Dr. Robinson, is before us as we write. The other specimens examined by us are enumerated below, under

E. sessilifolium L., var. **Vaseyi** (Porter), comb. nov. *E. Vaseyi* Porter, Bull. Torr. Bot. Cl. xix. 128 (1892). Maryland: dry woods between Quantico and Salisbury, *Tidestrom*, no. 7427. District of Columbia: in vicinis Washington, September 30, 1877, *L. F. Ward;* Brooklands, September 1, 1895, *Holm;* thickets, September 11, 1896, *Steele.* Virginia: The Pinnacle, Lee Co., July 27, 1892, *Small;* Halifax, August, 1927, *Wm. Rhoades;* Bedford Co., August 31, 1871, *A. H. Curtiss;* Craigs, Craig Co., *Steele*, no. 21; dry rocky woods along Potto Creek, 7 miles from Covington, Alleghany Co., *Griscom*, no. 18,780. West Virginia: Dailey's Post Office, Jefferson Co., *Wm. Palmer*, no. 49; dry roadside thicket, Upshur Co., *S. S. Dickey*, no. 156.

The other four so-called "species" prove to have no constant or fundamental characters separating them. The plants currently called *E. verbenaefolium* and *E. rotundifolium* are two well marked extremes, but *E. pubescens* is a hopeless series of leaf variations, containing every possible connecting stage between these two extremes in outline. Indeed, unrecorded variations have membranaceous and smooth, instead of thick and rough, leaves; while occasional plants have obtusish rather than acutish bracts. Eighty per cent of the plants growing west of or outside of the coastal plain belong to this intermediate series, and field experience is required to understand their distribution. Thus, in the Shenandoah valley and in the Alleghanies of Virginia and West Virginia, one of the surprises of local work is the presence of coastal plain species in limestone barrens or sandy valleys, with the rich piedmont flora flourishing on the wooded hillsides a hundred yards away. No hint of this situation can be found on the labels of older collections.

There are also difficulties in nomenclature. The available names are nearly all specific; they are old names and the types, all in European herbaria, have never been critically discussed by a person familiar with the genus today. Photographs of nearly all of them are now in the Gray Herbarium, thanks to the interest of Dr. Robinson, who has most kindly placed them at our disposal. Their study makes it quite impossible to endorse current stereotyped usage in several cases. A summary of these types is given below.

E. ROTUNDIFOLIUM L. = *E. rotundifolium* as currently understood.
E. VERBENAEFOLIUM Michx. = *E. pubescens* as currently understood.
E. TEUCRIFOLIUM Willd. = *E. pubescens* as currently understood.
E. PUBESCENS Muhl. = *E. pubescens* as currently understood.
E. LANCEOLATUM Muhl. in Willd., of which we have seen no photograph but of which Muhlenberg's own material is preserved at the Academy of Sciences of Philadelphia, is clearly the narrow-leaved extreme of *E. verbenaefolium* as currently understood, and Asa Gray was quite correct in citing it under his *E. teucrifolium*, not the *E. teucrifolium* of Willd.

Those who wish to maintain these three "species" must determine the identity of Walter's *E. pilosum* and *E. Marrubium* to settle the nomenclature. We cannot interpret *E. Marrubium* any better than Asa Gray, but *E. pilosum* is obviously either the *E. pubescens* or *E. verbenaefolium* of current manuals and is a far older name than either. We do not settle the identity of these Walter types, as we do not regard these plants as species and are consequently solely concerned with varietal names. We recognize the following varieties:

E. ROTUNDIFOLIUM L., var. **typicum.** *E. rotundifolium* L. Sp. Pl. 837 (1753).—Leaves suborbicular to broadly deltoid-ovate, relatively small, the middle ones 2–5.5 cm. long, nearly as broad as long, usually strongly canescent on both surfaces; the rounded to subacute teeth relatively uniform; uppermost leaves very rarely alternate (in only 3 out of 65 sheets examined).—Passing freely into

Var. OVATUM (Bigelow) Torrey in DC. Prodr. v. 178 (1836). *E. ovatum* Big. Fl. Bost. ed. 2: 296 (1824). *E. pubescens* Muhl. in Willd. Sp. Pl. iii. 1755 (1804).—Leaves often less pubescent, in extreme cases thinner and glabrate, with coarser toothing; lower and median ovate to elliptic or broadly oblong, obtuse to subacute; the middle ones 4–10 cm. long; uppermost leaves rarely alternate (in 13 out of 74 examined).

Var. SCABRIDUM (Elliott) Gray, Syn. Fl. i.[2] 99 (1884). *E. scabridum* Ell. Sk. ii. 298 (1821–24).—Stems puberulent; leaves scabrous-puberulent, rhombic-ovate, often cuneate at base, the larger 3–6.5 cm. long, the toothing much as in var. *typicum;* uppermost cauline leaves rarely alternate (in 4 out of 23).

Var. **lanceolatum** (Muhl.), comb. nov. *E. lanceolatum* Muhl. ex Willd. Sp. Pl. iii. 1752 (1804). *E. verbenaefolium* of recent authors, not Michx. *E. teucrifolium* of recent authors, not Willd.—Lower and middle leaves narrowly lance-ovate to elliptic-oblong, obtuse to acute; the median 4–9 cm. long, with relatively few, coarse teeth, the lower teeth often prolonged; uppermost leaves narrowly ovate to lanceolate, acute to acuminate, usually alternate (in 68 out of 78); pubescence and texture much as in var. *ovatum.*

Eupatorium perfoliatum L., var. **colpophilum**, var. nov., a forma typica differt caulibus glabratis vel puberulis; foliis glabrescentibus angustioribus 0.6–2.5 cm. latis; involucris glabrescentibus nec non dense pilosis.—Tidal flats of the St. Lawrence River, Quebec and the Kennebec-Androscaggin system, Maine. The following (all collections seen from these estuaries) belong here. Quebec: Berthier, Montmagny Co., July 14, 1922, *Fernald & Pease*, no. 25,296; Berthier, August 13, 1925, *Rousseau*, no. 21,300 (type in Gray Herb.); St. Augustine, Portneuf Co., August 7, 1923, *Svenson & Fassett*, nos. 2050 and 2051 (individual with 3 leaves); Beauport, August 8, 1922, *Victorin*, no. 15,347. Maine: Bowdoinham, September 14 and 19, 1916, *Fernald & Long*, no. 14,650; Bowdoinham, August 24, 1921, *Fassett*, nos. 343–346.

Much of the Maine material has been referred to forma *purpureum* Britton, because of the purplish involucres and flowers. Forma *purpureum*, however, is a purplish-flowered form of typical *E. perfoliatum*, with densely pilose involucre and pubescent leaves. Var. *colpophilum* was detected by us while studying the variations of *E. perfoliatum* in our Virginia collections. The species is very variable and we feel, after going over much material, that var. *truncatum* (Muhl.) Gray (*E. truncatum* Muhl.) is not a true variety or anything but an occasional aberration. *E. cuneatum* Engelm. (*E. perfoliatum*, var. *cuneatum* Engelm.), however, with campanulate heads and short round-tipped involucral bracts is apparently a distinct species, nearly related to the local *E. resinosum* Torr. of pine barrens of New Jersey and Delaware.

Liatris graminifolia Willd., var. **Smallii** (Britton), comb. nov. *Laciniaria Smallii* Britton, Man. 927 (1901). Virginia: dry oak woods, The Desert, Cape Henry, no. 2907.

Our material, growing with other typical Alleghenian plants in comparatively rich woods, is a perfect match for the type-collection of *Laciniaria Smallii*, from Iron Mountain, Smyth Co. A well defined variety on account of its comparatively open inflorescence, often with peduncled heads, and its often broad lower leaves, the plant seems to have no satisfactory characters to separate it specifically from *Liatris graminifolia*. Var. *Smallii* is a characteristic plant of the Alleghenies from southwestern Virginia to Georgia and Tennessee. Its discovery at Cape Henry adds another to the considerable list of Alleghenian types isolated there.

In studying the variations of *Liatris graminifolia* one other variety has seemed to us specially worthy of note. This is the hirsute plant, dominant near the northern end of the range of the species, in New

Jersey, and occurring locally southward to Florida. This is the plant which was apparently intended as *Laciniaria graminifolia pilosa* by Britton, as indicated by the description and range given in his Manual, 927 (1901). The combination, first made by Britton (Mem. Torr. Bot. Cl. v. 314) in 1895, rested, however, directly upon *Serratula pilosa* Ait. Hort. Kew, iii. 138 (1789) and was supposed to cover also *Liatris graminifolia*, var. *dubia* (Barton) Gray. As to *Serratula pilosa*, Aiton's description was brief but very definite: "S. foliis linearibus pilosis, floribus axillaribus longe pedunculatis." The second phrase alone should indicate that Aiton had something quite unlike *Liatris graminifolia*, which has the heads sessile or on peduncles shorter than the involucres. Fortunately fragments of a head from Aiton's type, long ago presented to Asa Gray, are before us. These show the involucral bracts to be linear and acute, thus proving conclusively that *Serratula pilosa* has nothing to do with *Liatris graminifolia*.

Liatris dubia Bart., to which Gray doubtfully referred *Serratula pilosa*, is, as shown by Barton's plate and description, suggestive of Aiton's plant but, again, cannot be closely related to *Liatris graminifolia*.

Liatris graminifolia Willd. Sp. Pl. iii. 1636 (1804), itself was a mixture at the start. Willdenow gave an original diagnosis which is clearly recognizable; but he derived the name from Walter's *Anonymos graminifolius*, Fl. Car. 197 (1788). The latter, however, was described as 6 feet (1.8 m.) high, a measurement seemingly impossible for our plant. Since, however, Willdenow's account contained an original diagnosis and a more detailed original description of a specimen actually before him, we are leaving *Liatris graminifolia* as Willdenow's species.

The hirsute plant should be called

L. GRAMINIFOLIA Willd., var. **lasia**, var. nov., foliis hirsutis; caule plus minusve hirsutis. TYPE: dry sandy soil, Lindenwold, Camden Co., NEW JERSEY, September 29, 1923, *J. M. Fogg, jr.*, no. 622 (in Gray Herb.). Frequent in southern New Jersey and locally southward on the outer coastal plain to Florida. Our collection from Virginia is from dry sandy barrens, Cape Henry, no. 2909, growing with typical *L. graminifolia* (no. 2908).

ASTER SUBULATUS Michx., var. **euroauster**, var. nov. (TAB. 251, FIGS. 1 et 3), capitulis plerumque dissitis vix glomerulatis; involucris 5–7 mm. longis; bracteis scariosis lineari-attenuatis; foliis plerumque anguste linearibus.—Brackish to fresh wet places, eastern Massachusetts to Florida; inland near Syracuse, New York; chiefly southern.

Type: border of gum swamp near North Landing, Norfolk Co., Virginia, September 22, 1933, *Fernald & Griscom*, no. 2919 (in Gray Herb.; isotype in herb. Griscom).

Typical *Aster subulatus* Michx. Fl. Bor.-Am. ii. 111 (1803) is the plant common on salt marshes and brackish shores from New Hampshire to Delaware, the whole plant often suffused with purple, the slightly larger heads (6–8 mm. long) tending to become crowded and subsessile (fig. 2), the bracts herbaceous and lance-linear, the basal and cauline leaves tending to lanceolate rather than narrowly linear. Var. *euroauster* is far more characteristic of brackish tide-water or even fresh habitats northward, whereas typical *A. subulatus* is most characteristic of open salt marshes.

According to Gray (Synoptical Flora), *Aster subulatus* of Michaux was a mixture of *A. exilis* Ell. from "Carolinae" and *A. subulatus* in our sense from "Pensylvaniae." Gray, as the first reviser of the tangle, took up the latter element as typical *A. subulatus* and his notations on the sheets which were before him indicate the coarser salt marsh plant of the North as true *A. subulatus;* while two sheets from Florida of var. *euroauster* were marked "a slender Florida form."

Iva frutescens L., var. **oraria** (Bartlett), comb. nov. *I. oraria* Bartlett, Rhodora, viii. 26 (1906).

The plants of marshes in Princess Anne Co., like specimens from Cape Charles, have the leaves nearly as in *I. oraria*, but the smaller and more subsessile heads of *I. frutescens*. The achenes might go with material of either extreme. A transitional series, combining in varying degrees the foliage and the involucres and achenes of the two, extends from southeastern Virginia to Cape May. North of southern New Jersey the larger-headed and broader-leaved var. *oraria* alone seems to be found; south of Virginia the material is all the narrow-leaved and usually smaller-headed typical *I. frutescens*.

Ambrosia artemisiaefolia and its Variations in temperate eastern North America. The polymorphous annual weed, well known to every one as Ragweed or Bitterweed, consists of many trends, which in the North American Flora are treated by Rydberg as about 10 species. Without venturing on a final decision regarding the status of some of these, it is clear to us that in the northeastern United States and adjacent Canada all the variations belong to one specific type. We should classify them as follows:

Leaves simple, coarsely pinnatifid or rarely bipinnatifid: staminate involucres 3–7 mm. broad . . . . *A. artemisiaefolia* (typical).

Leaves bi- to tripinnatifid, with smaller segments: staminate involucres 1.5–5 mm. broad.
Staminate involucre 2.5–5 mm. broad.
Plant glabrous or appressed-pubescent.................... Var. *elatior.*
Plant spreading-villous............................ Var. *elatior*, f. *villosa.*
Staminate involucre 1.5–2.5 mm. broad.................. Var. *paniculata.*

A. ARTEMISIAEFOLIA L. Sp. Pl. ii. 988 (1753); Rydb. N. Am. Fl. xxxiii. 18 (1922).—Sea-beaches and cultivated or waste land, Magdalen Islands and Nova Scotia to Pennsylvania and (acc. to Rydberg) District of Columbia.

Var. ELATIOR (L.) Descourtils, Fl. Ant. i. 239, t. 55 (1821). *A. elatior* L. l. c. (1753); Rydb. l. c. (1922).—Ubiquitous weed of United States and southern Canada, extending to the West Indies and naturalized in Europe.—*A. media* Rydb. Bull. Torr. Bot. Cl. xxxvii. 127 (1910) seems to us only a stiffish inland phase of var. *elatior;* and *A. glandulosa* Scheele, Linnaea, xxii. 157 (1849) and *A. diversifolia* (Piper) Rydb. N. Am. Fl. l. c. (1922) seem hardly recognizable.

Forma **villosa**, f. nov., var. *elatiori* similis sed caulis foliisque plus minusve villosis, villis divergentibus.—Prince Edward Island to Oregon and southward. TYPE: Fayette, IOWA, August, 1894, *Bruce Fink* in Gray Herb.

Var. PANICULATA (Michx.) Blankinship, Rep. Mo. Bot. Gard. xviii. 173 (1907). *A. paniculata* Michx. Fl. Bor.-Am. ii. 183 (1803). *A. monophylla* Walt. Fl. Carol. 232 (1788).—Southeastern United States, north, locally, as a weed to Massachusetts, New Hampshire and New York.

It is possible that there is an earlier valid varietal name, but var. *paniculata,* based upon *A. paniculata,* is definite; other names, like var. *jamaicensis* Griseb. Fl. Brit. W. Ind. 370 (1861), based merely on the cutting of the leaf are not clearly identifiable.

HIERACIUM GRONOVII L., var. FOLIOSUM Michx. VIRGINIA: dry oak woods, Cape Henry, nos. 2934, 2935.

Hieracium Gronovii L. has two strong varietal tendencies. Typical *H. Gronovii,* as determined by Asa Gray, on comparing the Clayton (Gronovian) specimen, is equivalent to var. *nudicaule* Michx. Fl. Bor.-Am. ii. 87 (1803) and includes var. *subnudum* Torr. & Gray, Fl. ii. 477 (1843). This plant has the larger leaves subbasal as in *H. venosum* or extending remotely up the lower third of the stem and rarely more than 4 or 5 in number. Its inflorescence is open and varying from thyrsoid-cylindric to almost corymbose. The latter plants strongly simulate *H. venosum* but can always be distinguished from it by the markedly fusiform or upwardly attenuate achenes and by the stouter and more heavily glandular pedicels.

Var. *foliosum,* which is clearly an earlier name for the plant described as var. *hirsutissimum* Torr. & Gray, l. c. (1843) and as *H.*

pensilvanicum Fries Symb. Hierac. 150 (1844), has numerous cauline leaves extending nearly or quite into the inflorescence, more oval and rounded at summit, the panicle slenderly cylindric-ellipsoid and commonly 2–7 dm. long. It is dominant on the coastal plain, extending rather rarely into southern New England and northward in the interior to southern Indiana and Missouri; whereas typical *H. Gronovii* predominates northward and in the interior.

EXPLANATION OF PLATES 332–351

Plate 332. Juniperus virginana L.: fig. 1, adult foliage, × 10, from Tower Rock, Missouri, *Gleason*, no. 1778; fig. 2, foliage and fruit, × 10, from Nimmo, Virginia, *Fernald & Griscom*, no. 2703; fig. 3, foliage, × 10, from Cedar Cliff Mt., Buncome Co., North Carolina, *Biltmore Herb.*, no. 2624; fig. 4, foliage, × 10, from Waynesboro, Tennessee, *Svenson*, no. 4308 (transition to var. *crebra*); fig. 5, seed, × 10, from Tower Rock, Missouri, *Gleason*, no. 1778; fig. 6, seed, × 10, from Cliff Mt., North Carolina, *Biltmore Herb.* no. 2624; figs. 7 and 8, seeds, × 10, from same no. as fig. 2; fig. 9, seed, × 10, from Tennessee, *Svenson* no. 4308 (transition to var. *crebra*).

Plate 333. Juniperus virginiana, var. crebra, n. var.: fig. 1, adult foliage, × 10, from McCall's Ferry, Pennsylvania, *Heller & Halbach*, no. 705; fig. 2, foliage, × 10, from Barnstable, Massachusetts, *Fernald & Long*, no. 17,797 (type); fig. 3, foliage, × 10, from Fairfield, Connecticut, October 1, 1899, *E. H. Eames;* fig. 4, foliage, × 10, from West Fort Anne, New York, November 12, 1895, *S. H. Burnham;* fig. 5, seed, × 10, from Pennsylvania, *Heller & Halbach*, no. 705; fig. 6, seed, × 10, from Fairfield, Connecticut, *Eames;* fig. 7, seed, × 10, from West Fort Anne, New York, *Burnham;* fig. 8, seed, × 10, from Massachusetts, *Fernald & Long*, no. 17,797 (type).

Plate 334. Cinna arundinacea L.: fig. 3, spikelets, × 12, from the type region, environs de Montréal, *Victorin*, no. 28,445.

C. arundinacea, var. inexpansa, n. var.: fig. 1, panicle, × 1, from North Landing, Norfolk Co., Virginia, *Fernald & Griscom*, no. 2732; fig. 2, spikelets, × 12, from no. 2732.

C. latifolia (Trev.) Griseb.: fig. 4, spikelets, × 12, from Grand Falls, Newfoundland, *Fernald & Wiegand*, no. 4586.

Plate 335. Aristida lanosa Muhl. var. macera, n. var.: fig. 2, plant, × ½, from Cape Henry, Virginia, *Fernald & Griscom*, no. 2719 (type); fig. 1, lemma, × 2, from no. 2719.

Plate 336. Echinochloa pungens (Poir.) Rydb., var. coarctata, n. var.: fig. 1, panicle, × 1, from Pungo Ferry, Princess Anne County, Virginia, *Fernald & Griscom*, no. 2760 (type); fig. 2, spikelet, × 10, from no. 2760.

E. pungens, var. ludoviciana (Wieg.) Fern. & Grisc.: fig. 3, spikelet, × 10, from Baton Rouge, Louisiana, *Billings*, no. 14 (type).

Plate 337. Variations of Andropogon virginicus L., panicles × ½: fig. 1, A. virginicus (genuinus), from Newport, Delaware, Sept. 30, 1899, *W. M. Canby;* fig. 2, var. glaucus Hackel, from Okeechobee region, Brevard Co., Florida, *Fredholm*, no. 6121; fig. 3, var. tetrastachyus (Ell.) Hackel., from Jacksonville, Florida, *A. H. Curtiss*. no. 5571; fig. 4, var. glaucopsis (Ell.) Hitchc., from Apalachicola, Florida, *Biltmore Herb.* no. 921 a.

Plate 338. Variations of Andropogon virginicus, panicles × ½: fig. 1, var. tenuispatheus (Nash) Fern. & Grisc., from near St. Petersburg, Florida, *C. C. Deam*, no. 1886; fig. 2, var. corymbosus (Chapm.) Fern. & Grisc., from Florida, 1884, *A. H. Curtiss;* fig. 3, var. abbreviatus (Hack.) Fern. & Grisc., from Hammonton, New Jersey, *Gershoy*, no. 30.

Plate 339. Variations of Andropogon scoparius Michx., racemes × 2, habits × ½: fig. 4, A. scoparius (genuinus), from Florida, *Chapman:* fig. 3, var. frequens Hubbard, from Block Island, Rhode Island, *Fernald*,

Long & Torrey, no. 8476 (TYPE); FIGS. 1 & 2, var. SEPTENTRIONALIS, n. var., from Baie Sherley, Riv. Ottawa, Quebec, *Rolland-Germain*, no. 19,199 (TYPE); FIG. 5, var. NEO-MEXICANUS (Nash) Hitchc., from Cedar Point, Erie Co., Ohio, *R. J. Webb*, no. 5503.

PLATE 340. VARIATIONS OF ANDROPOGON SCOPARIUS, racemes × 2, habit × ½: FIGS. 1 & 2, var. DUCIS, n. var., from Naushon, Dukes Co., Massachusetts, *Fogg*, no. 2940 (TYPE); FIG. 3, var. DIVERGENS Hackel, from Braidentown, Florida, *Combs*, no. 1298 (type of var. *polycladus* Scribn. & Ball); FIG. 4, var. LITTORALIS (Nash) Hitchc., from Cape Henry, Virginia, *Fernald & Griscom*, no. 2768.

PLATE 341. CYPERUS STRIGOSUS L., umbels × 1: FIG. 1, TYPE in Herb. Linnaeus (from photograph sent by Mr. S. SAVAGE, Assistant Secretary of the Linnean Society of London); FIG. 2, Texas, *Drummond*, no. 287 (ISOTYPE of *C. uniflorus* Torr. & Hook.); FIG. 3, west of San Antonio, Texas, *E. Palmer*, no. 2018 (as *C. uniflorus*); FIG. 4, Auburn, Maine, August 18, 1888, *J. C. Parlin;* FIG. 5, Placerville, California, *Bolander*, no. 6224 (as *C. stenolepis* [Wats., not] Torr. = *C. Hanseni* Britton); FIG. 6, Agricultural College, Mississippi, August 24, 1889, *F. S. Earle;* FIG. 7, Adams, Massachusetts, *M. A. Day*, no. 37.

PLATE 342. CYPERUS RETRORSUS Chapm., var. TYPICUS: FIG. 1, inflorescence, × 1, from High Springs, Florida, *Wiegand & Manning*, no. 466 (distributed as *C. cylindricus*), a close match for Chapman's type; FIG. 2, spike, × 4, from no. 466.

C. RETRORSUS, var. NASHII (Britton) Fern. & Grisc.: FIG. 3, part of inflorescence, × 1, from Eustis, Lake Co., Florida, *Nash*, no. 1196 (ISOTYPE of *C. Nashii*); FIG. 4, spike, × 4, from no. 1196.

C. RETRORSUS, var. CYLINDRICUS (Ell.) Fern. & Grisc.: FIG. 5, inflorescence, × 1, from Middle Oconee River, Clarke Co., Georgia, *Harper*, no. 100; FIG. 6, spike, × 4, from no. 100.

C. RETRORSUS, var. DEERINGIANUS (Britton & Small) Fern. & Grisc.: FIG. 7, portion of inflorescence, × 1, from near Great Bridge, Norfolk Co., Virginia, *Fernald & Long*, no. 3725; FIG. 8, spike, × 4, from no. 3725.

PLATE 343. CYPERUS FILICULMIS Vahl, var. OBLITUS, n. var.: FIG. 1, inflorescence, × 1, from Cape Henry, Virginia, *Fernald & Griscom*, no. 2793 (TYPE); FIG. 2, glomerule, × 2, from TYPE.

C. FILICULMIS, var. MACILENTUS Fernald: inflorescence, × 2, from Orono, Maine, *Fernald*, no. 343 (TYPE).

C. FILICULMIS (typical): FIG. 4, ripe glomerule, × 2, from Alva, Oklahoma, *Stevens*, no. 1667 (characteristic *C. Bushii* Britton); FIG. 5, ripe glomerule, × 2, from Hingham, Massachusetts, September 6, 1914, *J. R. Churchill;* FIG. 6, ripe glomerule, × 2, from Cedar Cliff Mountain, North Carolina, *Biltmore Herb.* no. 329a.

PLATE 344. PSILOCARYA SCIRPOIDES Torr.: FIG. 3, inflorescence, × 1, from Brewster, Massachusetts, *Fernald*, no. 16,336; FIG. 4, achene, × 35, from Plymouth, Massachusetts, *Oakes*.

P. SCIRPOIDES var. GRIMESII, n. var.: FIG. 1, inflorescence, × 1, from Cape Henry, Virginia, *Fernald & Griscom*, no. 2770; FIG. 2, achene (with top of style broken off), × 35, from Lake Drummond, Dismal Swamp, Virginia, *Grimes*, no. 4534 (TYPE).

P. NITENS (Vahl) Wood: FIG. 5, achene, × 35, from Santee Canal, South Carolina, *Ravanel*.

P. CORYMBIFERA (C. Wright) Benth.: FIG. 6, achene (without beak), × 35, from near Pinar del Rio, Cuba, *C. Wright*, no. 3774 (TYPE).

PLATE 345. ROTALA RAMOSIOR (L.) Koehne, var. INTERIOR, n. var.: FIG. 1, portion of TYPE, × 1, from Knox Co., Tennessee, *Ruth*, no. 224; FIG. 2, fruits, × 5, from near Cincinnati, Ohio, September 2, 1883, *C. G. Lloyd;* FIG 3, fruits, transitional, × 5, from Webb City, Missouri, *E. J. Palmer*, no. 2626.

R. RAMOSIOR: FIG. 4, fruits, × 5, from Island Brook Reservoir, Bridgeport, Connecticut, September 20, 1896, *E. H. Eames*.

PLATE 346. RHEXIA VENTRICOSA, n. sp.: FIG. 1, fruiting plant and flowering tip, × ½, from east of Little Creek, Princess Anne Co., Virginia, *Fernald & Long*, no. 4046 (TYPE); FIG. 2, fruiting hypanthium, × 4, from TYPE; FIG. 3, seeds, × 10, from near Pungo, Princess Anne Co., Virginia, *Fernald & Griscom*. no. 2870; FIG. 4, seed, × 50, from TYPE.

R. VIRGINICA L.: FIG. 5, seed, × 50, from Brewster, Massachusetts, *Fernald & Long*, no. 17,196.

R. INTERIOR Pennell: FIG. 6, seed, × 50, from Waco, Missouri, *E. J. Palmer*, no. 1256.

R. MARIANA L.: FIG. 7, seed, × 50, from Brewster, Massachusetts, *Fernald*, no. 18,818.

R. MARIANA, var. LEIOSPERMA, n. var.: FIG. 8, seed, × 50, from Montgomery Co., Texas, *R. A. Dixon*, no. 487 (TYPE).

PLATE 347. RHEXIA VIRGINICA L.: FIG. 1, base of plant showing tuber and stolons, × 1, from cobbly beach of St. John's (Wilson's) Lake, Yarmouth Co., Nova Scotia, *Fernald, Bartram & Long*, no. 24,194; FIG. 2, base of plant, showing tuber and stolon, × 1, from sphagnum, near Williamsburg, Virginia, *Grimes*, no. 4315; FIG. 3, elongate and spongy base of plant, × 1, from a bog, Cold Spring, New Jersey, *Gershoy*, no. 499; FIG. 4, fruiting hypanthium, × 4, from Buckhannon, West Virginia, *S. S. Dickey*, no. 195.

R. MARIANA L., var. PURPUREA Michx.: FIG. 5, base of plant showing horizontal rhizomatous stems, × 1, from Cape Henry, Virginia, *Fernald & Long*, no. 4061; FIG. 6, fruiting hypanthium, × 4, from Ocean Springs, Mississippi, *Pollard*, no. 1077.

R. INTERIOR Pennell: FIG. 7, fruiting hypanthium, × 4, from Waco, Missouri, *E. J. Palmer*, no. 1256.

R. ARISTOSA Britton: FIG. 8, fruiting hypanthium, × 4, from Sumter Co., Georgia, *Harper*, no. 466.

PLATE 348. LUDWIGIA SPHAEROCARPA Ell., var. TYPICA: FIG. 1, portion of fruiting plant, × 1, from Valdosta, Georgia, *A. H. Curtiss*, no. 6710; FIG. 2, fruit, × 4, from no. 6710.

Var. JUNGENS, n. var.: FIG. 3, top of a fruiting plant, × 1, from Ellendale, Delaware, September 1, 1892, *Commons;* FIG. 4, fruit, × 4, from same.

Var. MACROCARPA, n. var.: FIG. 5, portion of fruiting plant, × 1, from Lakeville, Massachusetts, August 27, 1899, *W. P. Rich* (TYPE); FIG. 6, fruit, × 4, from the TYPE.

Var. DEAMII, n. var.: FIG. 7, portion of fruiting plant, × 1, from Lake Walker, Porter Co., Indiana, *Deam*, no. 42,350 (TYPE); FIG. 8, fruit, × 4, from TYPE.

PLATE 349. LUDWIGIA, § ISNARDIA. L. NATANS Ell., var. TYPICA: FIG. 2, fruit, × 4, from Braidentown, Florida, *Tracy*, no. 7592.

L. NATANS, var. ROTUNDATA (Griseb.) Fern. & Grisc.: FIG. 3, fruit, × 4, from Texas, *E. Hall*, no. 223.

L. NATANS, var. STIPITATA, n. var.: FIG. 1, node, × 1, from San Bernardino, California, 1881, *G. R. Vasey;* FIG. 2, flower, × 4, from same collection.

L. PALUSTRIS (L.) Ell., var. TYPICA: FIG. 7, fruit, × 4, from Subcarpathian Russia, *Margittai* in Fl. Exsicc. Reipubl. Bohem. Slov.. no. 349.

L. PALUSTRIS, var. AMERICANA (DC.) Fern. & Grisc.; FIG. 8, fruit, × 4, from Hyannisport, Massachusetts, August 9, 1888, *Walter Deane*.

L. PALUSTRIS, var. PACIFICA Fern. & Grisc.: FIG. 5, small plant, × 1, from TYPE-collection, Sproat Lake, Vancouver Island, *W. R. Carter*, no. 128; FIG. 9, fruit, × 4, from TYPE.

L. PALUSTRIS, var. NANA, n. var.: FIG. 6, fruiting branch, × 1, from Florida, *Chapman* in Bilt. Herb. no. 600a; FIG. 10, fruit × 4, from Cameron, Louisiana. *Tracy*, no. 8718 (TYPE).

PLATE 350. LIPPIA LANCEOLATA Michx.: FIG. 1. flowering branch, × 1, from Knott's Island, Virginia, *Fernald & Long*, no. 4155.

L. LANCEOLATA, var. RECOGNITA, n. var.: FIG. 2, flowering branch, × 1. from the TYPE, Fremont Co., Iowa, *Fitzpatrick*.

PLATE 351. ASTER SUBULATUS Michx., var. EUROAUSTER, n. var.: FIG. 1, portion of flowering plant, × 1, from North Landing, Norfolk Co., Virginia, *Fernald & Griscom*, no. 2919 (TYPE) · FIG. 3, heads, × 2, from TYPE.

A. SUBULATUS (typical): FIG. 2, heads, × 2, from Scituate, Massachusetts, September 6, 1896, *E. F. Williams*.

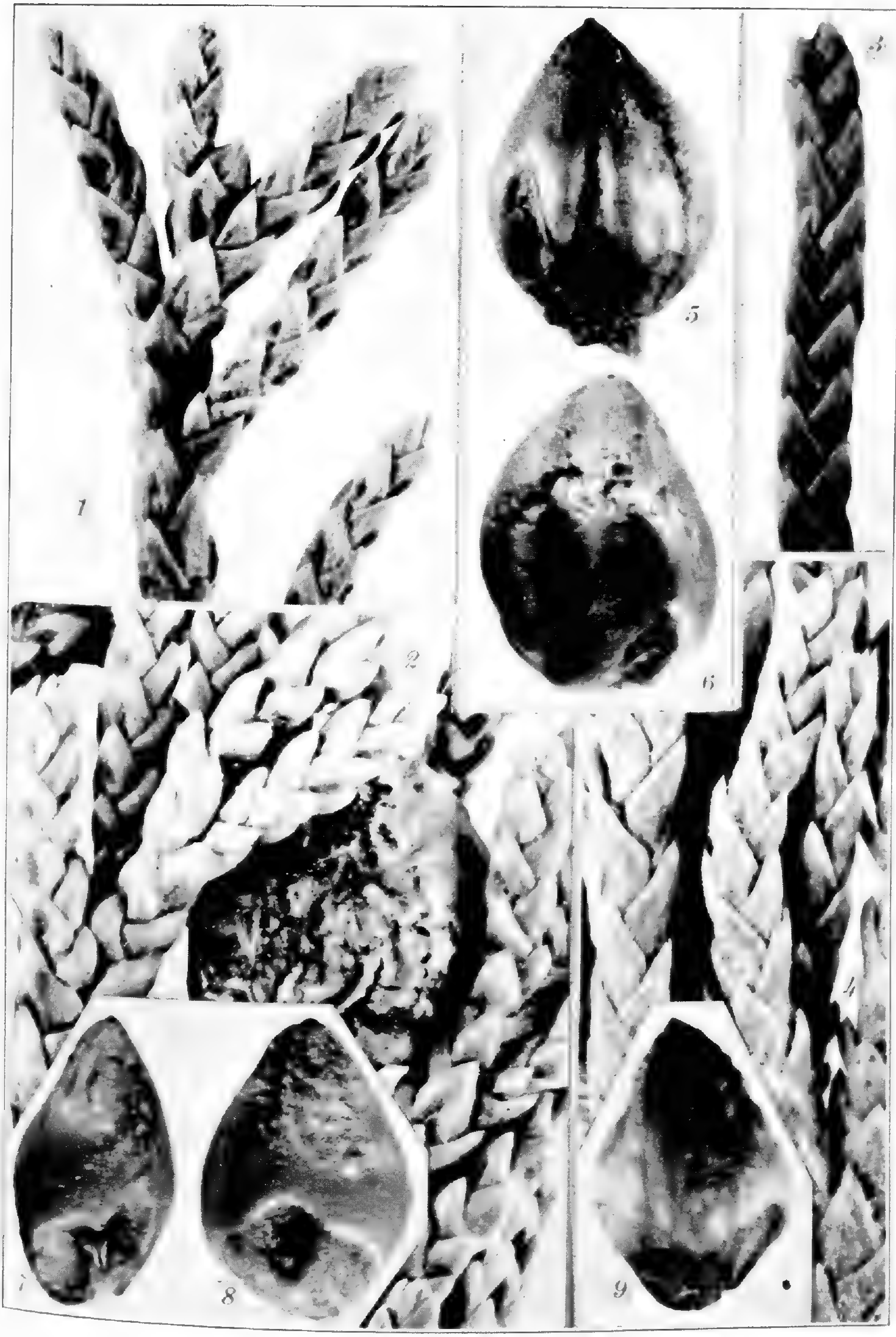

Photo. *E. C. Ogden.*

JUNIPERUS VIRGINIANA; foliage, × 10; seeds, × 10: FIG. 1, from Missouri; FIG. 2, from Virginia; FIG. 3, from North Carolina; FIG. 4, from Tennessee; FIG. 5, from Missouri; FIG. 6, from North Carolina; FIGS. 7 and 8, from Virginia; FIG. 9, from Tennessee.

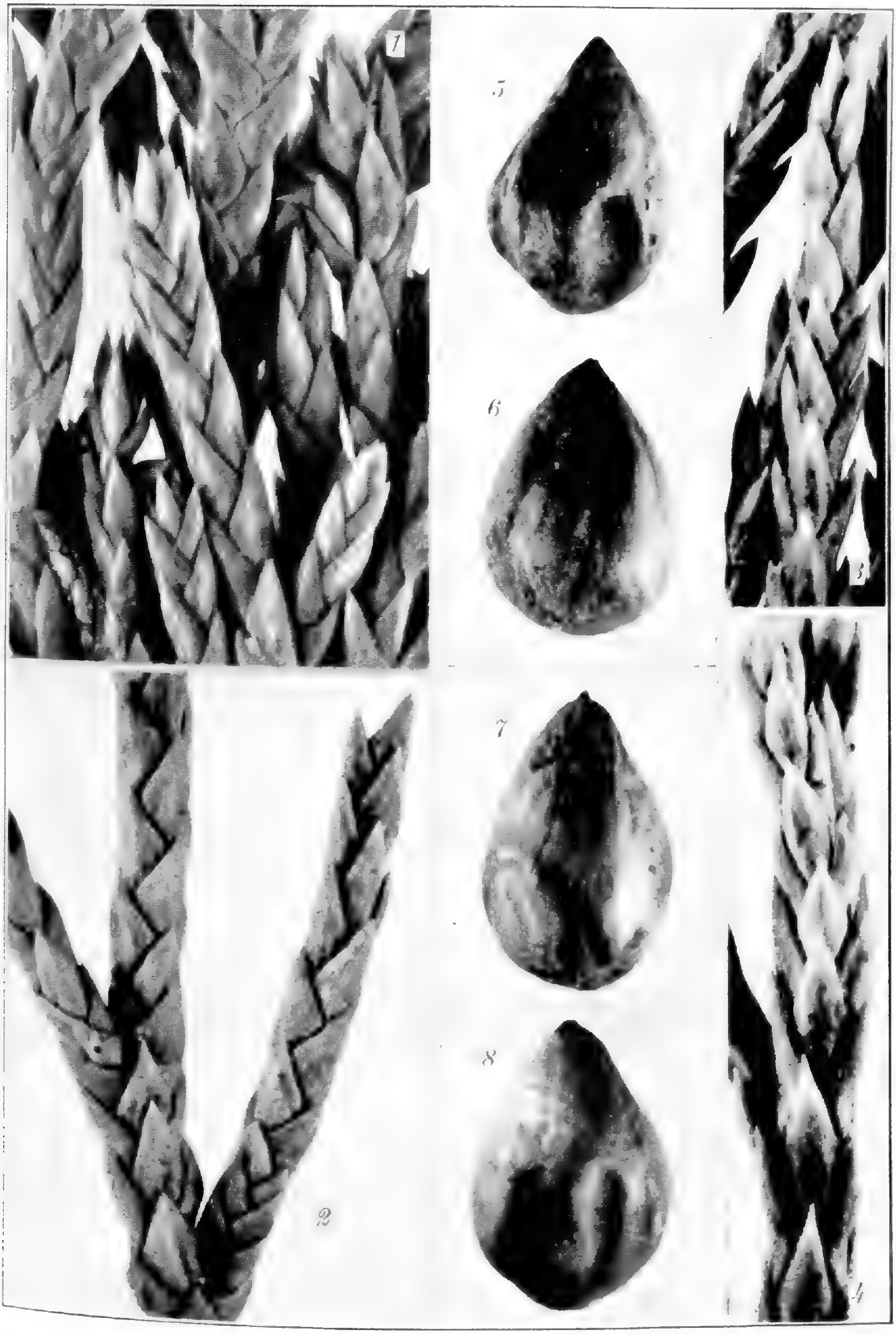

Photo *E. C. Ogden.*

JUNIPERUS VIRGINIANA, var. CREBRA; foliage, × 10; seeds, × 10: FIG. 1, from Pennsylvania; FIG. 2, from Massachusetts (*type*); FIG. 3, from Connecticut; FIG. 4, from New York; FIG. 5, from Pennsylvania; FIG. 6, from Connecticut; FIG. 7, from New York; FIG. 8, from Massachusetts (TYPE).

Photo. J. F. Collins.

CINNA ARUNDINACEA: FIG. 3, spikelets, × 12. C. ARUNDINACEA, var. INEXPANSA: FIG. 1, panicle, × 1; FIG. 2, spikelets, × 12. C. LATIFOLIA: FIG. 4, spikelets, × 12.

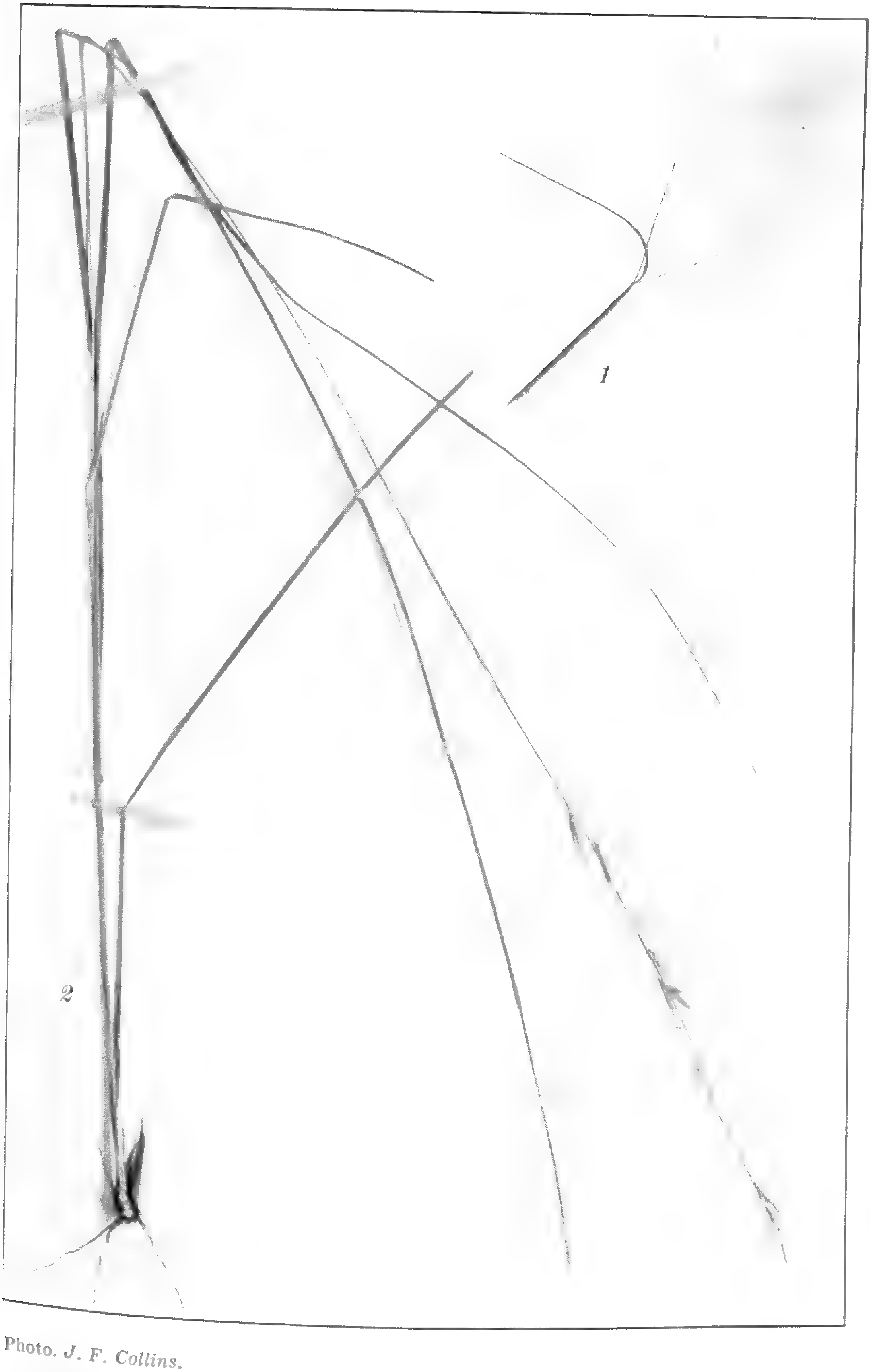

Photo. *J. F. Collins.*

ARISTIDA LANOSA, var. MACERA: FIG. 2, plant, × ½; FIG. 1, lemma, × 2.

Photo. *J. F. Collins.*

ECHINOCHLOA PUNGENS, var. COARCTATA: FIG. 1, panicle, × 1; FIG. 2, spikelet, × 10.

E. PUNGENS, var. LUDOVICIANA: FIG. 3, spikelet, × 10.

Photo. *J. F. Collins.*

ANDROPOGON VIRGINICUS AND VARIETIES; panicles, × ½.
FIG. 1, var. GENUINUS; FIG. 2, var. GLAUCUS; FIG. 3, var. TETRASTACHYUS; FIG. 4, var. GLAUCOPSIS.

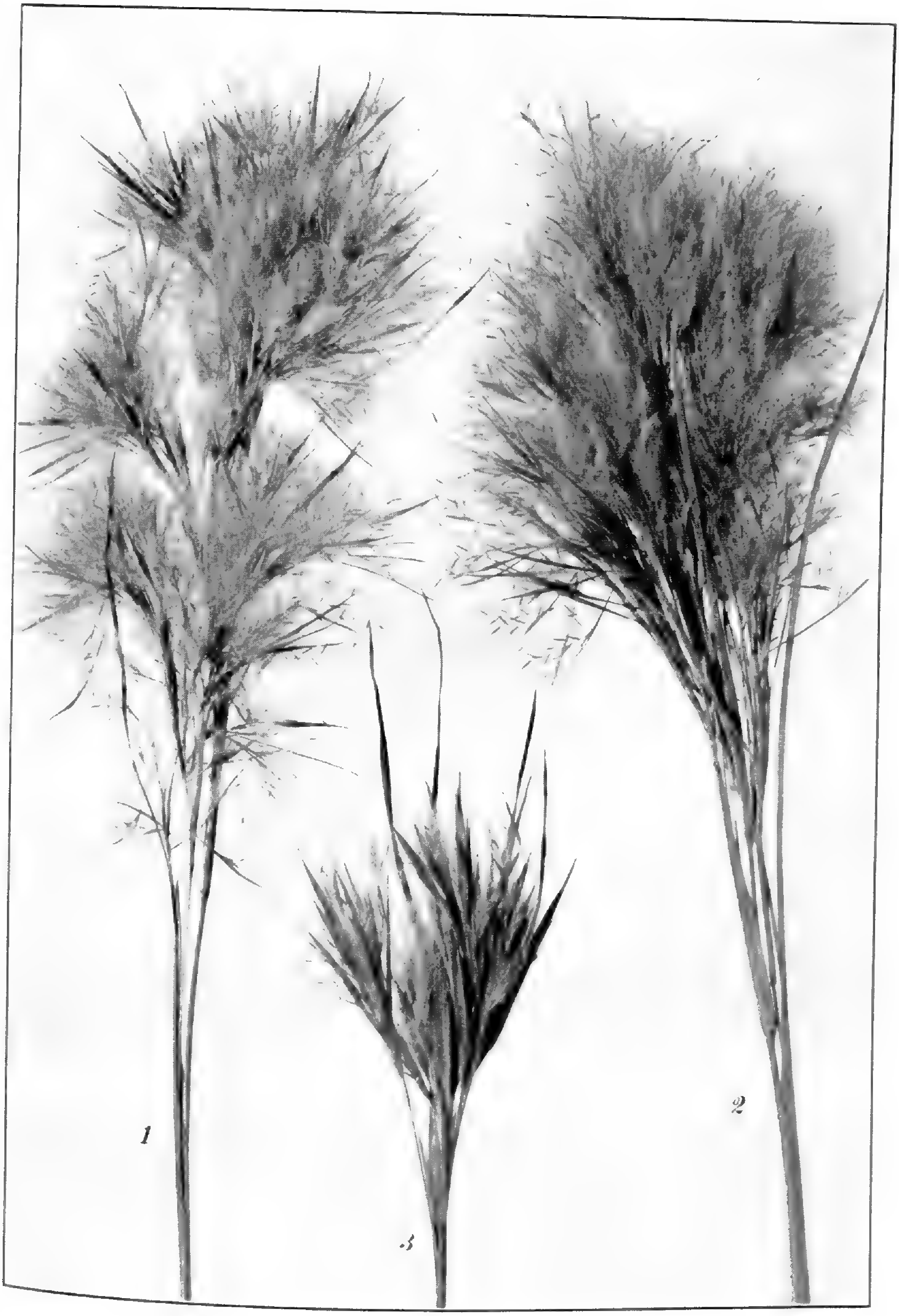

Photo. *J. F. Collins.*

ANDROPOGON VIRGINICUS AND VARIETIES; panicles, × 1/2.
FIG. 1, var. TENUISPATHEUS; FIG. 2, var. CORYMBOSUS; FIG. 3, var. ABBREVIATUS.

Photo. J. F. Collins.

Andropogon scoparius and Varieties; branches, × ½; racemes, × 2.
Figs. 1 and 2, var. septentrionalis; fig. 3, var. frequens; fig. 4, var. genuinus; fig. 5, var. neo-mexicanus.

Photo. *J. F. Collins.*

ANDROPOGON SCOPARIUS AND VARIETIES; habit, × ½; racemes, × 2. FIGS. 1 and 2, var. DUCIS; FIG. 3, var. DIVERGENS; FIG. 4, var. LITTORALIS.

Photo. *E. C. Ogden.*

UMBELS OF CYPERUS STRIGOSUS, × 1: FIG 1, TYPE in Herb. Linnaeus; FIG. 2, *isotype* of *C. uniflorus*, from Texas; FIG. 3, immature umbel of *C. uniflorus*, from Texas; FIG. 4, immature umbel, from Maine; FIG. 5, umbel of *C. Hanseni*, from California; FIG. 6, immature umbel, from Mississippi; FIG. 7, immature umbel, from Massachusetts.

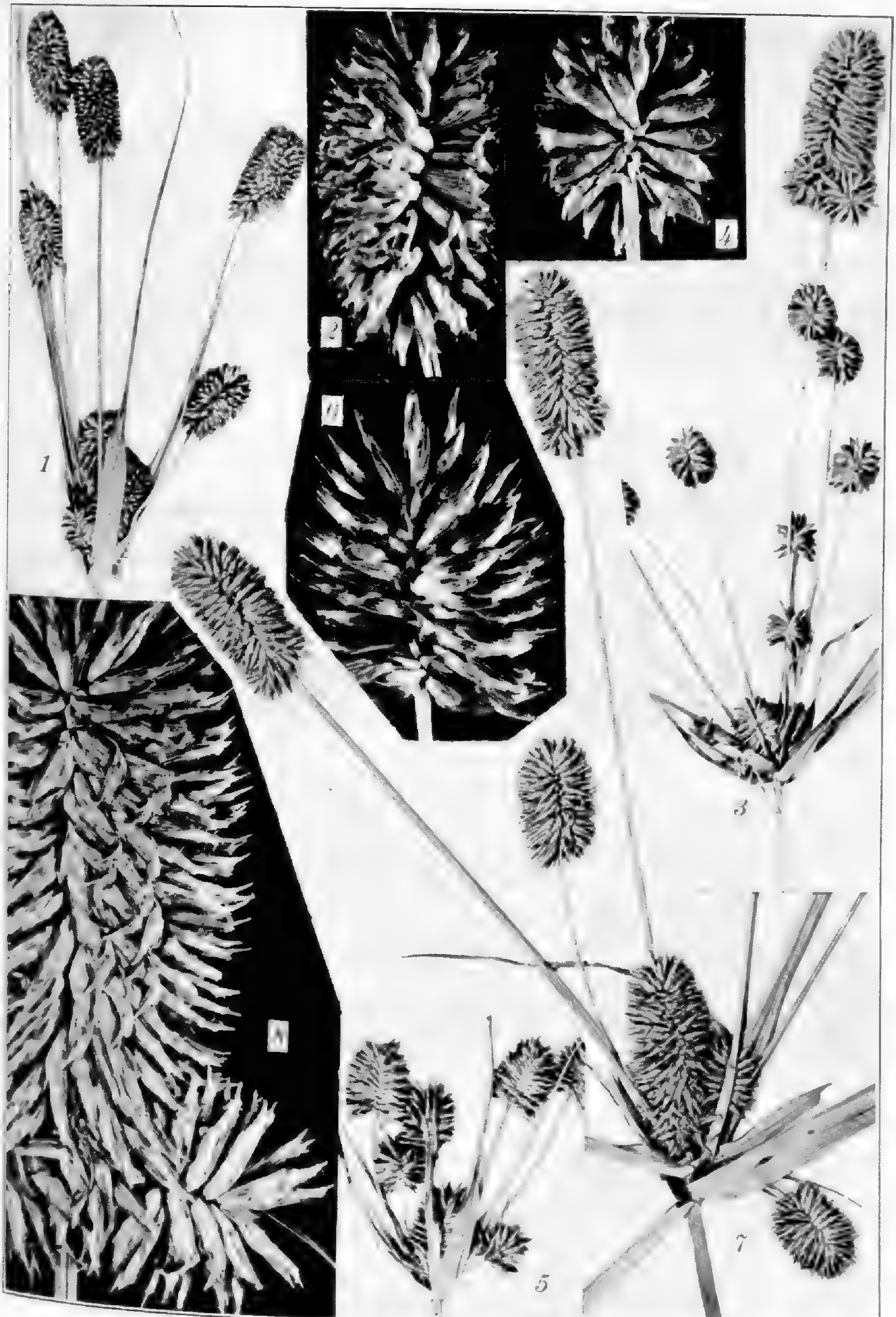

Photo. *E. C. Ogden*.

VARIETIES OF CYPERUS RETRORSUS; umbels, × 1; spikes, × 4.

Var. TYPICUS: FIGS. 1 and 2, from Florida.
Var. NASHII: FIGS. 3 and 4, from Florida (ISOTYPE).
Var. CYLINDRICUS: FIGS. 5 and 6, from Georgia.
Var. DEERINGIANUS: FIGS. 7 and 8, from Virginia.

Photo. *E. C. Ogden.*

CYPERUS FILICULMIS, var. OBLITUS: FIG. 1, umbel, × 1, from Virginia (TYPE); FIG. 2, glomerule, × 1, from TYPE.
C. FILICULMIS, var. MACILENTUS: FIG. 3. umbel, × 1, from Maine (TYPE).
C. FILICULMIS (typical); ripe glomerules, × 2: FIG 4, from Oklahoma (*C. Bushii*); FIG. 5, from Massachusetts; FIG. 6, from North Carolina.

Photo. E. C. Ogden.

PSILOCARYA, inflorescences, × 1; achenes, × 35.
P. SCIRPOIDES: FIGS. 3 and 4, from Massachusetts.
P. SCIRPOIDES, var. GRIMESII: FIG. 1, from Cape Henry, Virginia; FIG. 2, from Dismal Swamp, Virginia (TYPE).
P. NITENS: FIG. 5, from South Carolina.
P. CORYMBIFERA: FIG. 6, from Cuba (TYPE).

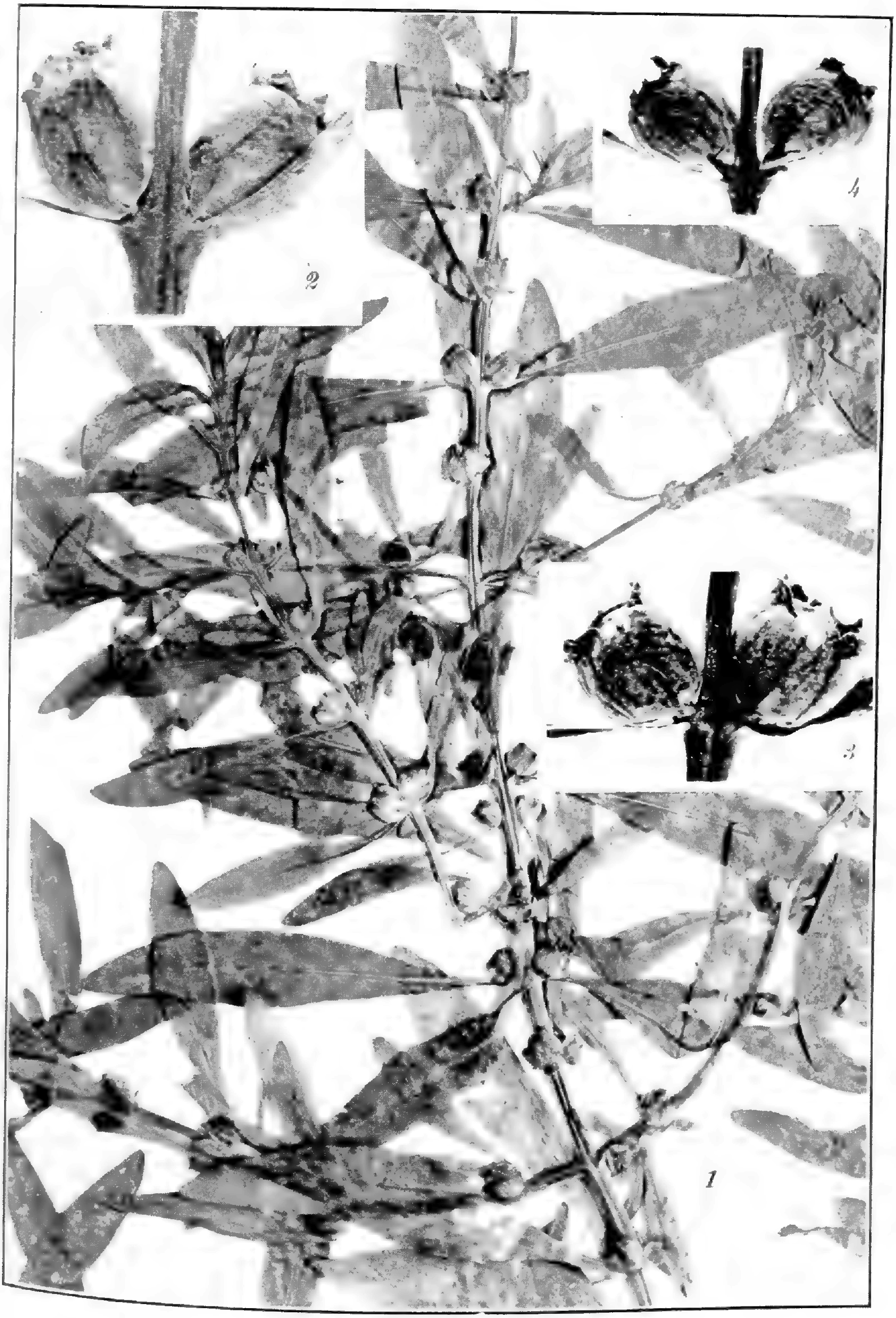

Photo. E. C. Ogden

ROTALA RAMOSIOR, var. INTERIOR: FIG. 1, portion of TYPE, × 1, from Tennessee; FIG. 2, fruit, × 5, from Ohio; FIG. 3, fruit (transitional), × 5, from Missouri. R. RAMOSIOR (typical): FIG. 4, fruits, × 5, from Connecticut.

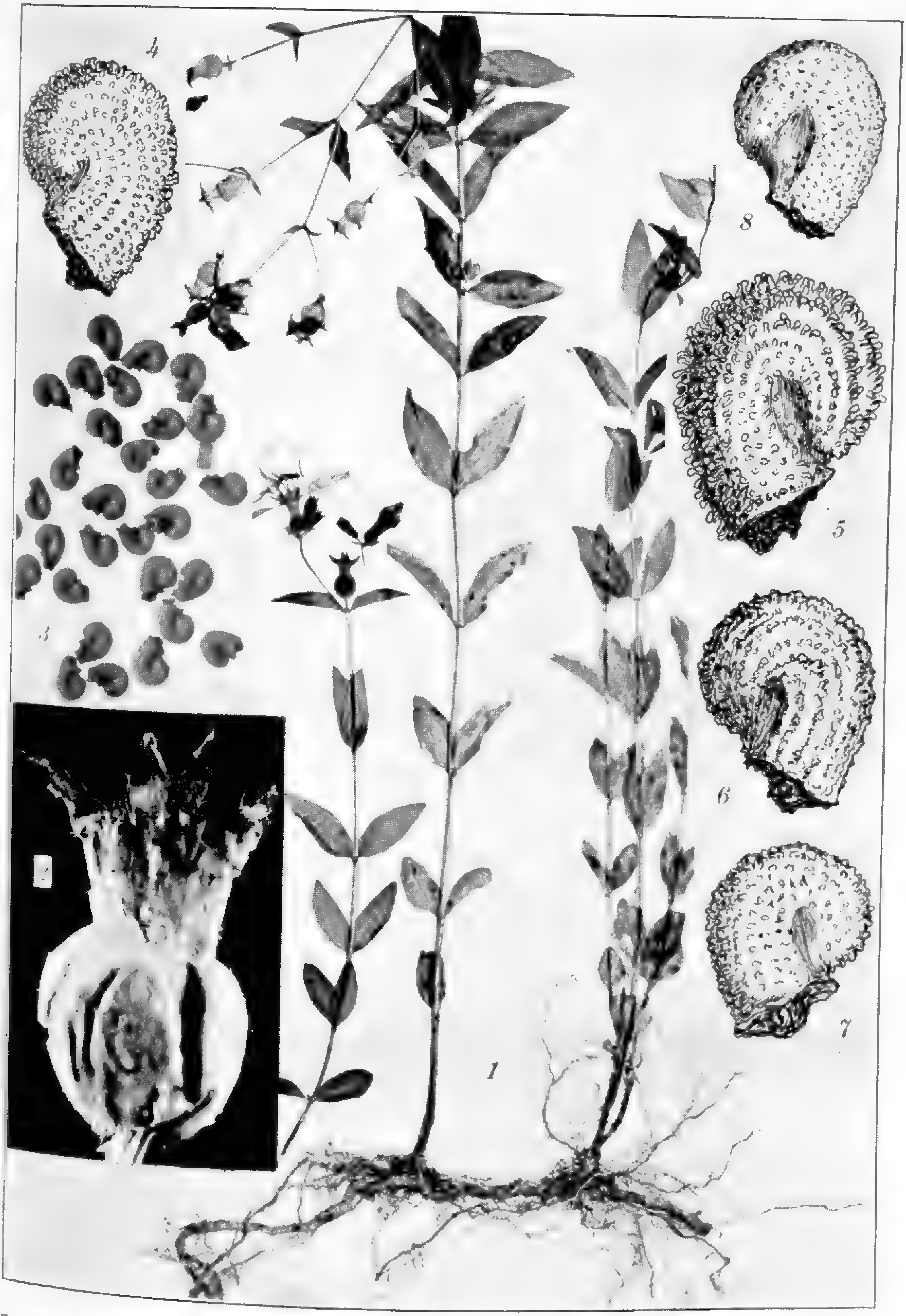

Photo. *E. C. Ogden*, drawings by *Ruth Peabody*.

RHEXIA VENTRICOSA: FIG. 1, TYPE, from Virginia, × ½; FIG. 2, fruiting hypanthium, × 4, from TYPE; FIG. 3, seeds, × 10 (by *J. F. Collins*) from Virginia; FIG. 4, seed, × 50, (from TYPE).
R. VIRGINICA: FIG. 5, seed, × 50, from Massachusetts.
R. INTERIOR: FIG. 6, seed, × 50, from Missouri.
R. MARIANA: FIG. 7, seed, × 50 from Massachusetts.
R. MARIANA, var. LEIOSPERMA: FIG. 8, seed, × 50, from Texas (TYPE).

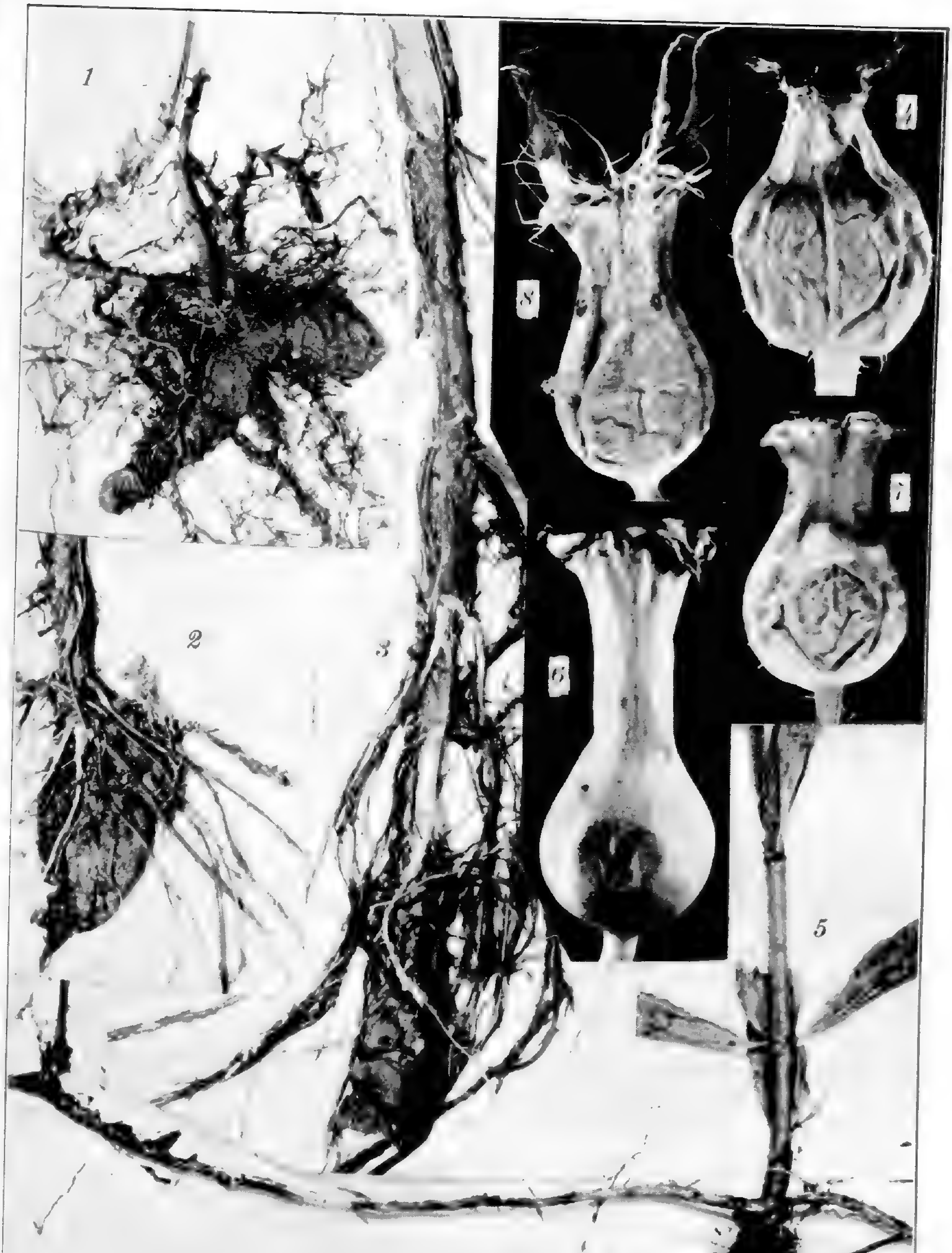

Photo. *E. C. Ogden.*

RHEXIA VIRGINICA, bases of plant, × 1: FIG. 1, from gravel; FIG. 2, from moss; FIG. 3, from bog; FIG. 4, fruiting hypanthium, × 4, from West Virginia.

R. MARIANA, var. PURPUREA: FIG. 5, base of plant, × 1, from Virginia; FIG. 6, fruiting hypanthium, × 4, from Mississippi.

R. INTERIOR: FIG. 7, fruiting hypanthium, × 4, from Missouri.

R. ARISTOSA: FIG. 8. fruiting hypanthium, × 4, from Georgia.

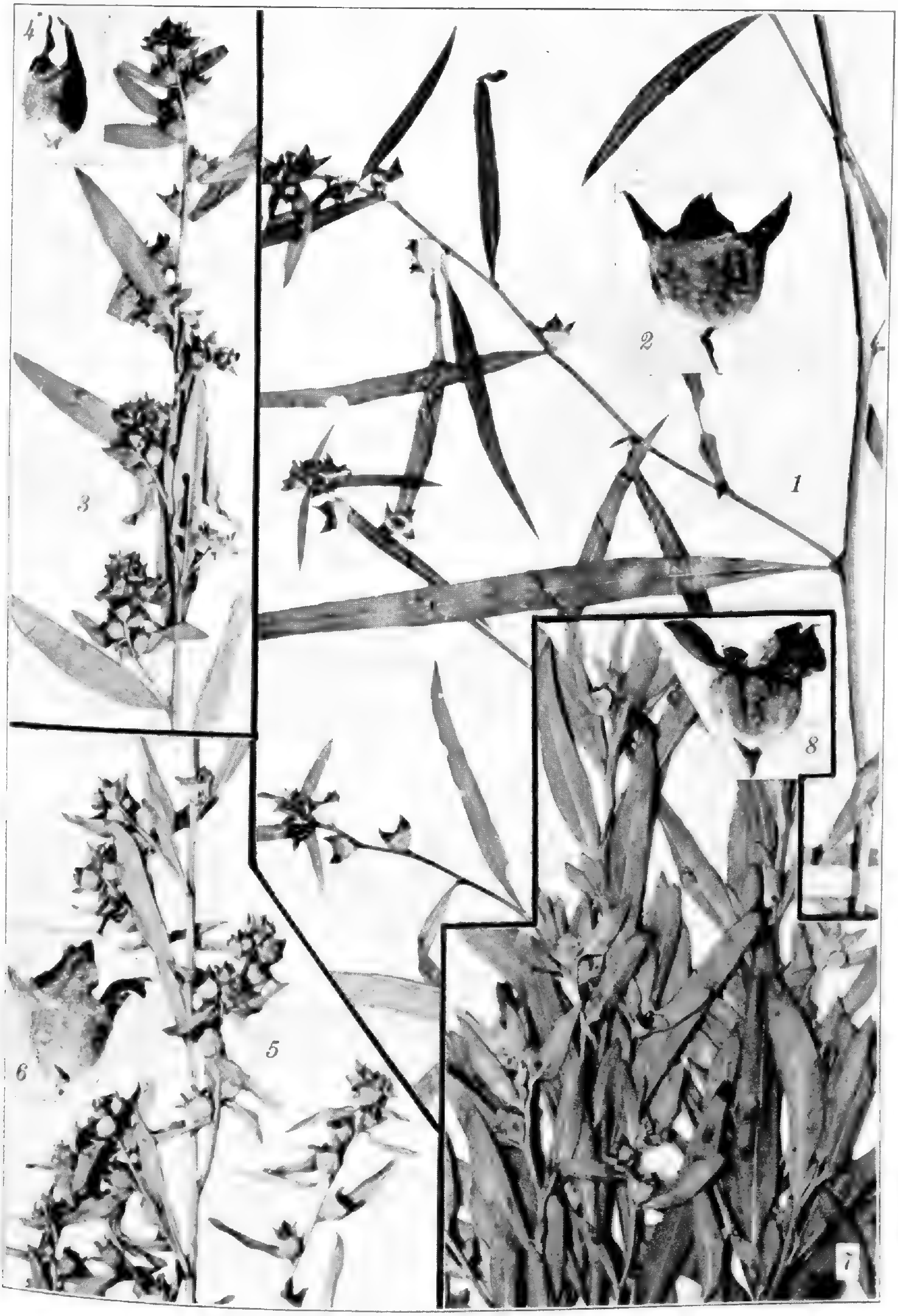

Photo. E. C. Ogden.

VARIETIES OF LUDWIGIA SPHAEROCARPA; habit, × 1; fruit, × 4.
Var. TYPICA: FIGS. 1 and 2, from Georgia.
Var. JUNGENS: FIGS. 3 and 4, from Delaware.
Var. MACROCARPA: FIGS. 5 and 6, from Massachusetts (TYPE).
Var. DEAMII: FIGS. 7 and 8, from Indiana (TYPE).

Photo. *J. F. Collins.*

Ludwigia, § Isnardia; branches, × 1; fruits, × 4.
L. natans, var. typica: fig. 2, from Florida.
L. natans, var. rotundata: fig. 3, from Texas.
L. natans, var. stipitata: figs. 1 and 4, from California.
L. palustris, var. typica: fig. 7, from Russia.
L. palustris, var. americana: fig. 8, from Massachusetts.
L. palustris, var. pacifica: figs. 5 and 9, from Vancouver Island (type).
L. palustris, var. nana: fig. 6, from Florida; fig. 10, from Louisiana (type).

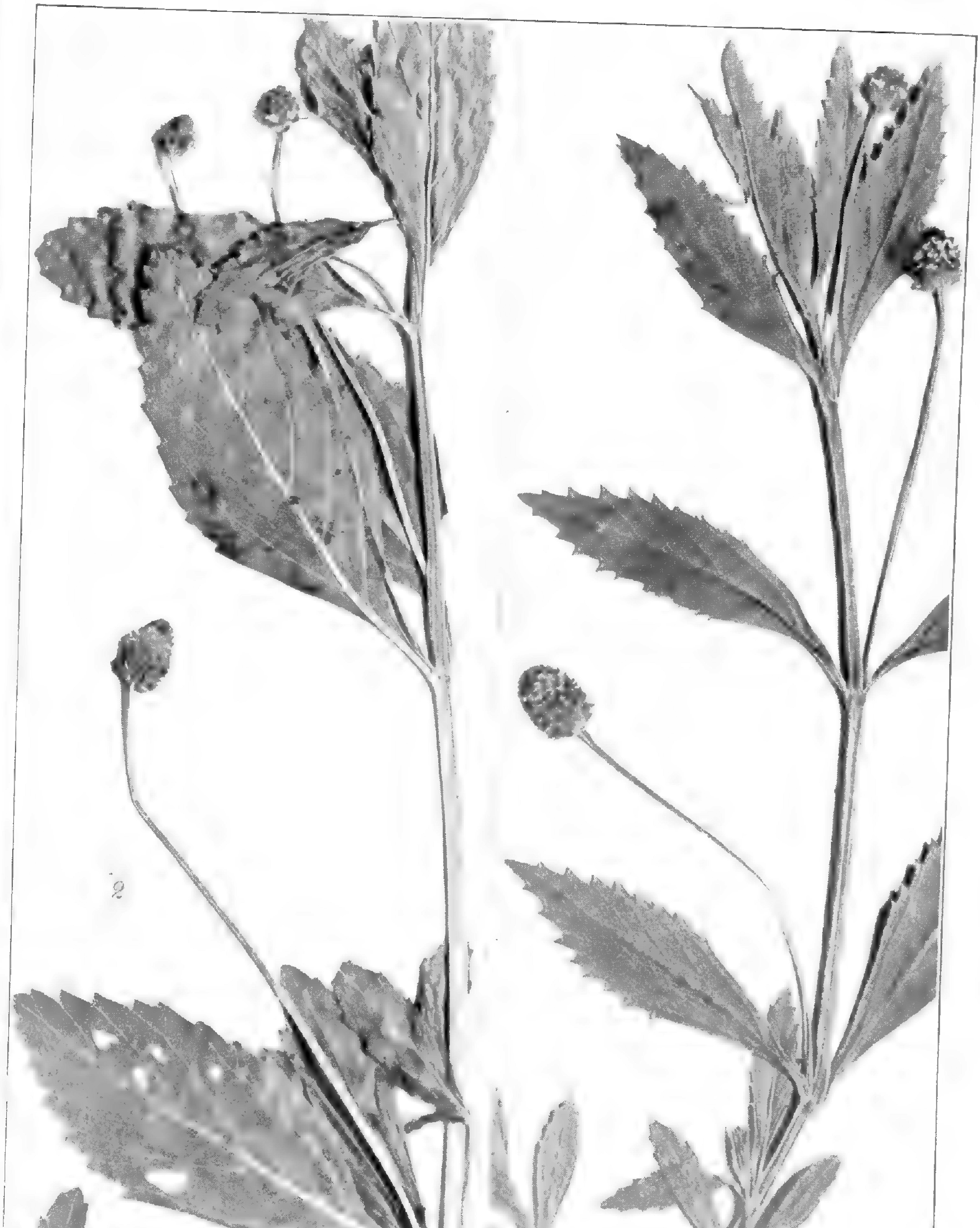

Photo. *E. C. Ogden.*

LIPPIA LANCEOLATA: FIG. 1, flowering branch, × 1, from Virginia.
L. LANCEOLATA, var. RECOGNITA: FIG. 2, flowering branch, × 1, from Iowa (TYPE).

Photo. E. C. Ogden

[illegible] SUBULATUS, var. EUROAUSTER: FIG. 1, portion of TYPE, × 1, from Virginia; [illegible] heads, × 2, from TYPE.
[illegible] SUBULATUS, typical: FIG. 2, heads, × 2, from Massachusetts.

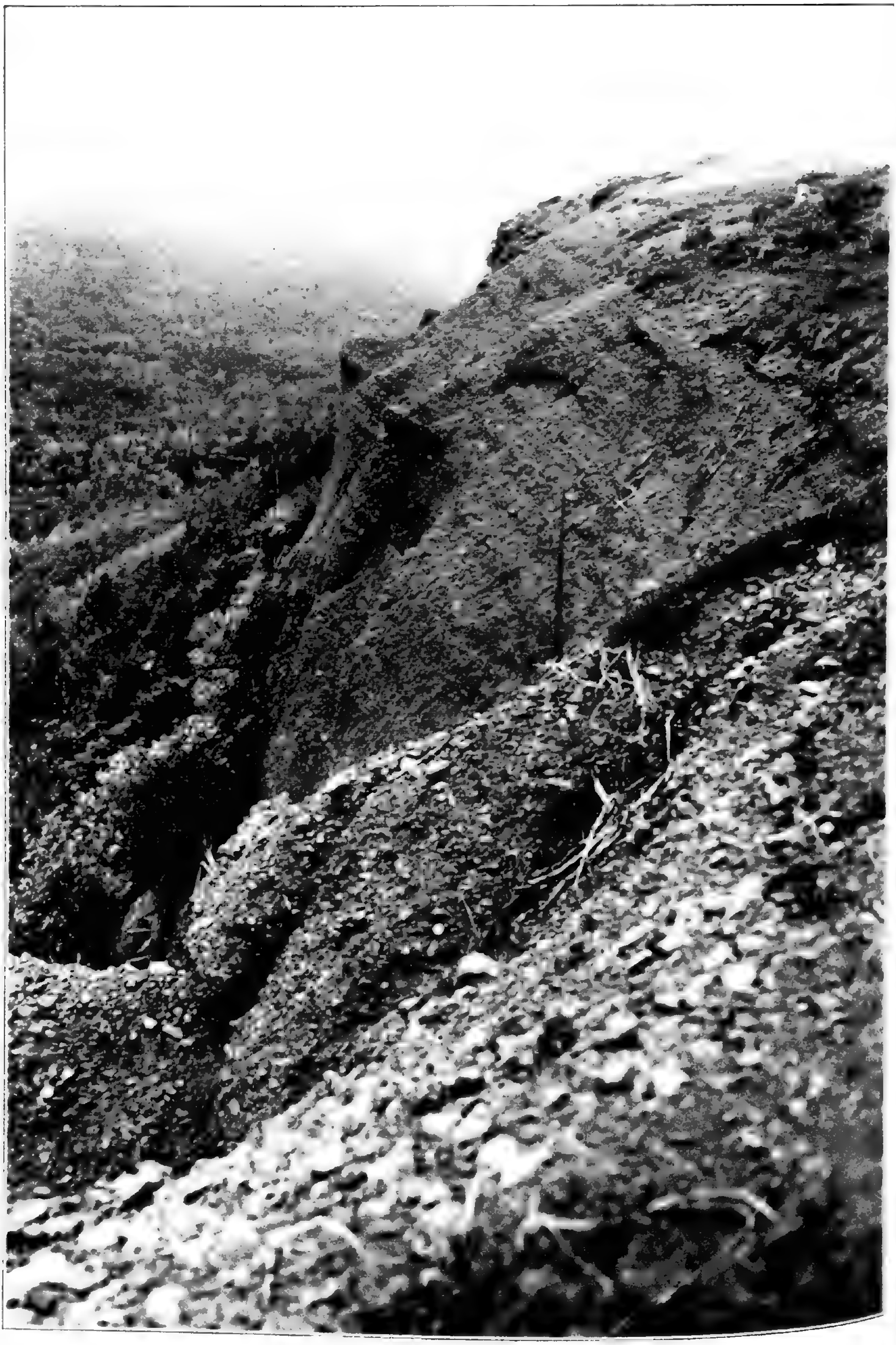

Photo H. G. Fernald.

West Bluff, Keweenaw Peninsula.

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CVIII

CRITICAL PLANTS OF THE UPPER GREAT LAKES REGION OF ONTARIO AND MICHIGAN

By M. L. FERNALD

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" 272–301 and Plates 363–375 .... 1 August, 1935
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CONTRIBUTIONS FROM THE GRAY HERBARIUM OF HARVARD UNIVERSITY—NO. CVIII

CRITICAL PLANTS OF THE UPPER GREAT LAKES REGION OF ONTARIO AND MICHIGAN

M. L. Fernald

(Plates 352–379)

Part I. The Pre-Wisconsin Flora of the Upper Great Lakes Region[1]

Ever since I learned through the distinguished student of the Pleistocene, Professor A. P. Coleman of the Royal Ontario Museum, that "Some suggestions have been made that parts of the north shore of Lake Superior and other high points on the Upper Lakes show little glaciation. On the Slate Islands [only station between the Rocky Mts. and Gaspé for *Dryas Drummondii*] some years ago I was surprised to find no evidence of glaciation"[2]; ever since Professor Coleman wrote these pregnant words I have yearned to see some of the country bordering the Upper Great Lakes. As a field-botanist, realizing the complete disagreement of the botanical evidence, of relic-colonies of remotely isolated or strictly endemic plants about the Great Lakes, and the current interpretation of many geologists, that the flora of the region has been completely wiped out by a wholesale very recent continental glaciation, the "suggestions" referred to by Coleman and his surprise "to find no evidence of glaciation" on the

[1] The substance of Part I was presented to the Royal Canadian Institute at Toronto on January 26 and to the New England Botanical Club at Boston on April 5.

[2] Coleman as quoted in Fernald, *Some Relationships of the Floras of the Northern Hemisphere*, Proc. Internat. Congr. Pl. Sci. ii. 1507 (1929).

Slate Islands in Lake Superior appealed to me. They were what I, as a botanist knowing something of the evidence supplied by the flora, would expect. However, except for the broad-visioned Coleman and one or two others, I could draw from most geologists no admission that any portions of the Upper Great Lakes region could

MAP 1. Availability for Occupation by Plants of North American Areas since the Paleozoic (*Map by* ALFRED W. LOTT).

possibly have passed unscathed through any of the several advances of the Pleistocene ice. The most extensive correlation of the plant-dispersal and geological history of that region is the detailed report of my friend, Gleason, on the *Vegetational History of the Middle West*.[1] There the orthodox interpretation is clearly stated, "the Wisconsin glaciers, which . . . flowed in a southwesterly direction into

[1] Gleason, Ann. Assoc. Am. Geogr. xii. 39–85 (1923).

our area, wholly covering the state of Michigan."[1] The elements of the vegetation of the Middle West (including Michigan, where the author had long lived and studied) were enumerated: "THE FIVE ELEMENTS IN THE FLORA OF THE MIDDLE WEST.—. . . .the vegetation of the Middle West . . . is found to be composed of five elements, not of equal importance, centering respectively in the southern Appalachian Mountains, in the southern Coastal Plain and the Mississippi Embayment, in the Ozark Mountains, in the plains of Kansas and Nebraska, and in Canada east of the Great Lakes."[2] Gleason seems not then to have considered (or recognized) the one element which most appeals to my heretical mind as indicating that not all of Michigan was "wholly covered" by Wisconsin ice. I refer to the numerically small but historically significant species of the Pacific slope or the Cordillera which are isolated about the Upper Great Lakes (see MAPS 6–14, 17–20).

The need of much fuller collections of critical plants and a better knowledge of the critical areas in the terrain bordering the Upper Great Lakes was apparent. Consequently, when my enthusiastic (*pulsating* they would say) friends, Pease and Bean (A. S. Pease and R. C. Bean), asked me to recommend a good region for botanical exploration, I suggested the almost inaccessible (except by private boat) portions of the high north shore of Lake Superior and also the Slate Islands. In the summer of 1933 they made successful explorations at various points, centering on Jack Fish and Schreiber, and made a partial survey of the Slate Islands. A full series of the collections of Pease and Bean was most generously deposited in the Gray Herbarium, some species easily identified; others, not so simple, set aside for intensive study, species not heretofore recognized as growing near the Great Lakes.

In June, 1934, it was my great privilege to supply, along with Professor Coleman, the lecture-programme of the Botanical Society of America, meeting at Toronto and then going by automobile to the unique Bruce Peninsula. The latter region, long famous for its several relic-species (*Phyllitis Scolopendrium* (MAP 2), *Polystichum Lonchitis* (MAP 3), *Asplenium cryptolepis* (MAP 5), *Sagittaria cristata, Melica Smithii* (MAP 11), *Festuca occidentalis, Habenaria unalascensis, Goodyera decipiens, Draba lanceolata, Drosera linearis, Rubus parviflorus* (MAPS 14–22), *Epilobium leptocarpum* var. *Macounii, E. panicu-*

[1] Gleason, l. c. 62.
[2] Gleason, l. c. 54.

latum, Aster ptarmicoides var. *lutescens, Adenocaulon bicolor* (MAP 9), etc.), far-isolated from the main areas of the species, was, necessarily in view of the large and diversely interested (and uninterested) party,

MAP 2. World-Range of PHYLLITIS SCOLOPENDRIUM.

shown us at only a few spots readily accessible to an auto-cavalcade. The botanists of the University of Toronto, notably Professors P. V. Krotkov and Thomas M. C. Taylor and their associates, have for some years been concentrating work on the region; and Dr. Stebbins of Colgate University recently published[1] his interpretation of the flora and notes on some of the specialties. As to recent glaciation of the Bruce Peninsula and adjacent areas (Grey County, etc.), those of us who had the superlative advantage of riding through the region with Coleman enjoyed his clear exposition, that the lower levels were in many areas most certainly invaded by Wisconsin ice and that the comparatively recent terraces of the Great Lakes were there well displayed; but, and this is the significant point, the highest outcrops of the Niagara escarpment there often display the undenuded and deeply rotted features which seem to indicate that the Wisconsin glaciation left them as nunataks (ice-free areas surrounded by glacial fields).

I am aware that to Stebbins "it seems unlikely that these nunataks were large enough to support a Canadian woodland flora."[2] He may be right; none of us were there to see. Nevertheless, it is most difficult to explain the extreme localization of the Hart's Tongue Fern in Bruce, Grey and Durham Counties unless it had some near-by source from which to spread. The species, *Phyllitis Scolopendrium* (L.) Newm. (*Scolopendrium vulgare* Sm.), has a disrupted range (MAP 2) which was achieved before the Pleistocene: the Mediterranean region from Iberia and northern Africa eastward to northern Persia, thence northward into west-central Asia, southern Scandinavia, Scotland and Ireland; the Macronesian Islands; Japan; and 5 very remote and very restricted areas in North America. Our plants are always on limestone or dolomite: a small colony in a ravine of the Meduxnakeag valley in western New Brunswick; a larger colony with a number of restricted stations "on shaded limestone cliffs and depressions in Onondaga and Madison counties," New York; a tiny colony in a cave near the southeast corner of Tennessee; and, 1450 miles further south, in the mountains of tropical Chiapas, an isolated variety. The one extensive area in North America is on the Bruce Peninsula and adjacent outcrops of dolomite in Ontario. There the Hart's Tongue is a rather frequent and locally abundant fern of fissures and depressions of wooded dolomite. So long as the American plants were considered identical with the European there lingered the possible interpretation that they had been recently brought from Europe and had found a few favorable habitats in which they could spread. Close examination of the American plants shows, however, that they differ in some very essential characters not found in the European plants.

[1] Stebbins, *Some Observations on the Flora of the Bruce Peninsula, Ontario*, RHODORA, xxxvii. 63–74 (1935).

[2] Stebbins, l. c. 69 (footnote).

In the more detailed sections of this paper I am treating them as two geographic varieties (plate 355), although the differences are such that some students may prefer to consider them as distinct species. Now, if the strictly North American variety of *Phyllitis Scolopendrium* reached the Bruce Peninsula region in post-Wisconsin time, whence did it come? The New Brunswick and New York stations are all within the area which we are taught to believe was overridden by Wisconsin ice and therefore present the same problem; and the Tennessee station is very tiny, deeply hidden and remote. If the American *Phyllitis Scolopendrium* has been migrating about New Brunswick, Ontario and New York since the Wisconsin (in present time) why have its abundant spores failed to make successful landings on hundreds of thousands of acres of equally available limestones and dolomites in eastern Canada and the northern States? In Bruce, Grey and Durham Counties the fern would rank as frequent and locally abundant and it there grows in the Alleghenian forest with species which abound all over Alleghenian America. Its isolation of colonies is not consistent with post-Wisconsin migration; it seems to me to be a pre-Wisconsin relic, belonging with the other relics to be discussed below.

Dr. Pease was so gratified by the success of himself and Bean in discovering puzzling plants or in extending ranges on the north shore of Lake Superior that he invited me to join him, after the Toronto meeting, for a brief trip to the south shore of Lake Superior, in Michigan. Accordingly, on June 27, I met him and my son, Henry G. Fernald, who accompanied us as alternate driver, photographer and general helper, at North Bay on Lake Nipissing. From there we drove, stopping when inviting territory was found or when some unrecognized plant was seen, by the regular automobile route through "the Soo" (Sault Ste. Marie), thence by the conventional route across the Upper Peninsula as far as the road would take us, nearly to Keweenaw Point. Our brief stops were numerous; but two areas received more attention than others: Cloche Peninsula and Great Cloche Island, on the north shore of Lake Huron, where we spent one very crowded day (with a brief but rather unproductive invasion of much burned Manitoulin Island[1]); and Keeweenaw County, the still gratifyingly wild and natural (except for old mines) tip of the Keweenaw Peninsula, where we had nearly four full days of absorbing botanizing. Much more time could have been advantageously given to the region

[1] See Fassett, Rhodora, xxxv. 389 (1933).

Photo. H. G. Fernald.

DENUDED HILLS, NEAR WASAPITEI, SUDBURY DISTRICT, ONTARIO.

but appointments at home forced us to leave many promising spots unvisited.

This necessary restriction of the time at our disposal forced us to forego the great pleasure it would have been to have accepted the invitations we had received from botanical associates in various parts of Michigan to visit them. If we had used our limited four days in journeys to Lansing, Detroit, Ann Arbor and Douglas Lake, we should never have reached our primary objective, Keweenaw County. It is a real disappointment now to learn that, without swerving from our rigid programme, we might, after all, have combined our Keweenaw trip with a visit to one of the pioneer botanists of that region, Oliver Atkins Farwell, who, quite unknown to us at the time, has returned to the Peninsula (at Lake Linden) and has there renewed[1] his botanical explorations which began in the 80's.

From our non-geological and foreign viewpoint it was difficult for us to see that *everywhere* through this region late Pleistocene activity had been so universal or so uniform as we had been led by many geologists to believe; or that the reputed wholesale and very recent submergence of the land under the lake-water had everywhere left visible evidences. In some areas, for instance much of the region north of Lake Huron, the denudation of the hills (PLATE 353) has been complete. In such tediously uniform country, with the vegetation consisting only of ubiquitous and rapidly invading or aggressive modern species (*Pteridium latiusculum, Athyrium angustum, Osmunda Claytoniana, Pinus Banksiana* and *resinosa, Panicum linearifolium, Oryzopsis pungens, Deschampsia flexuosa, Calamagrostis canadensis, Glyceria striata, Carex aenea, Crawfordii, gracillima, leptonervia, flava* and *arctata, Iris versicolor, Salix humilis, Populus tremuloides*, etc.), there was no temptation to linger. When we conscientiously tested such areas, which experience had long ago taught us were "no good," we came back empty-handed or, to save our faces and not be defeated, with a specimen or two "for locality."

In other sections, like portions of the Cloche Peninsula, some areas were thoroughly denuded, others had the ledges of greenstone, quartzite or limestone covered with a frost-broken mantle of unremoved debris *in situ*. In such a place botanizing, as always in spots of weathered rock, was productive: *Festuca occidentalis, Carex concinna, Habenaria unalascensis, Salix serissima, Polygonum Douglasii, Geum triflorum, Astragalus neglectus, Lathyrus ochroleucus, Epilobium*

[1] See Farwell, RHODORA, xxxvii. 164 (1935).

paniculatum, *Coreopsis lanceolata*, etc. The lowermost levels of Cloche Peninsula and of Great Cloche Island are very flat and, obviously, only recently emerged from the Lake. Their scoured and washed surface is a limestone pavement, often of a beautifully regular cancellate pattern. On this flat limestone pavement of the lakeside or in marshy depressions and savannahs upon it the widely dispersed calcicolous flora of the Great Lakes region luxuriates: *Equisetum variegatum*, *Agropyron trachycaulum*, *Eleocharis compressa*, *Carex Garberi* (described in this paper), *eburnea*, *Crawei*, etc., *Juncus balticus* var. *littoralis*, *J alpinus* vars., *Tofieldia glutinosa*, *Allium Schoenoprasum* var. *sibiricum*, *Comandra Richardsiana*, *Arenaria stricta*, *Potentilla fruticosa* and *Anserina*, *Polygala Senega*, *Rhus canadensis*, *Hypericum Kalmianum*, *Viola nephrophylla*, *Shepherdia canadensis*, *Satureja glabra*, *Castilleja coccinea*, *Lobelia Kalmii*, etc.

Similarly, on the Keweenaw Peninsula evidences of extensive and profound work by glaciers were obvious at many low levels; but at the higher levels, such as West Bluff (PLATE 352), 735 feet (224 m.) above Lake Superior, where the deeply weathered trap and conglomerate cliffs stand well above the levels of evident glacial till and denudation, subaerial decay and weathering have obliterated any apparent traces of glaciation, if there ever were any. The day we visited West Bluff (July 4th) the wind blew strongly up the face of the Bluff, which stands surrounded by a vast area of continuous forest. So rotted was the material of which it is composed that we were forced to fight our way against clouds of wind-blown sand and dust of purely local origin. In many areas of unquestioned Wisconsin glaciation which I have visited in New England and eastern Canada the conglomerates have not reached this state of decay, although they are in a region of quite as severe climate as that of northern Michigan. One would suppose that the thousands (probably hundreds of thousands) of years which have elapsed since the subaerial disintegration of West Bluff began should have sufficed to blow away all the dust, but every visitor there, when the wind sweeps up the Bluff, still gets his full "peck of dirt." Such a condition is not consistent with Wisconsin denudation as we understand it farther east.

Likewise, on the crests of more sheltered woodland bluffs and low ridges at elevations of 500 feet (150 m.) or even less above Lake Superior, such, for instance, as those on the north side of the "Mountain Drive" between West Bluff and Eagle Harbor, the angular and slow-weathering debris (PLATE 354), which forms the undisturbed mantle (just as if it were in the unglaciated southern Alleghenies), is striking evidence to a botanist, at least, that, while a late Pleistocene glaciation rendered botanically uninteresting such country as that shown in PLATE 353, it did not destroy the ancient vegetation on the higher areas (PLATES 352 and 354) of Keweenaw County. In fact, it seemed to us that the later glaciers, just as in eastern Canada, New York and New England,[1] had worked only on the lower levels; and on the Keweenaw Peninsula, as well as in Quebec, the Maritime Provinces and New England, precipitous bluffs and high ridges must have diverted the ice-flow, just as they can be seen to do today in many regions where continental glaciations still prevail.

It is significant, then, that Keweenaw County has a greater assemblage of remotely isolated relic-species and isolated endemics than any other botanically explored region between the Gaspé cliffs and mountains and The Driftless Area of Wisconsin, Minnesota, Iowa and Illinois. Here occur, usually isolated by many hundreds of miles and often by more than a thousand, colonies of such species as *Woodsia oregana*, *Polystichum Lonchitis* (MAP 3), *Asplenium montanum* (MAP 4), *A. cryptolepis* (MAP 5), the Rocky Mountain *Pteridium* (to be discussed later, known between the mountains of Quebec and the Black Hills only on the Bruce Peninsula and in northern Michigan), *Melica* (or *Bromelica*) *Smithii* (MAP 11), *Festuca occidentalis*, *Corallorrhiza striata*, an endemic variety of *Chamaerhodos Nuttallii* (MAP 10) of the Rocky Mountains and the Great Plains, *Crataegus Douglasii*, *Potentilla Blaschkiana*,[2] *Rosa Lunellii*,[2] *Ceanothus sanguineus* (MAP 6), *Chimaphila umbellata* var. *occidentalis*, *Vaccinium membranaceum* (MAP 7) and *ovalifolium*, *Collinsia parviflora*, *Adenocaulon bicolor* (MAP 9), an undescribed *Arnica* of the cordilleran series *Cordifoliae* and several others.

To some, who are unable to visualize the Pleistocene glaciation in the region from Newfoundland to the Great Lakes as NO MORE SEVERE THAN THAT WHICH NOW COVERS GREENLAND, WHERE AN EXTENSIVE TEMPERATE FLORA NOW OCCURS AT THE ICE-FREE MARGIN OF THE CONTINENTAL ICE-CAP, it apparently seems impossible that life could have persisted in the lower latitude of the Great Lakes region through the Pleistocene. It should not be overlooked, however, that the flora of approximately 400 species of vascular plants, which today grows on the ice-free areas of Greenland, is at the margin of a continental

[1] Extended discussion of this feature of New England and adjacent area will appear elsewhere.

[2] See Farwell, l. c.

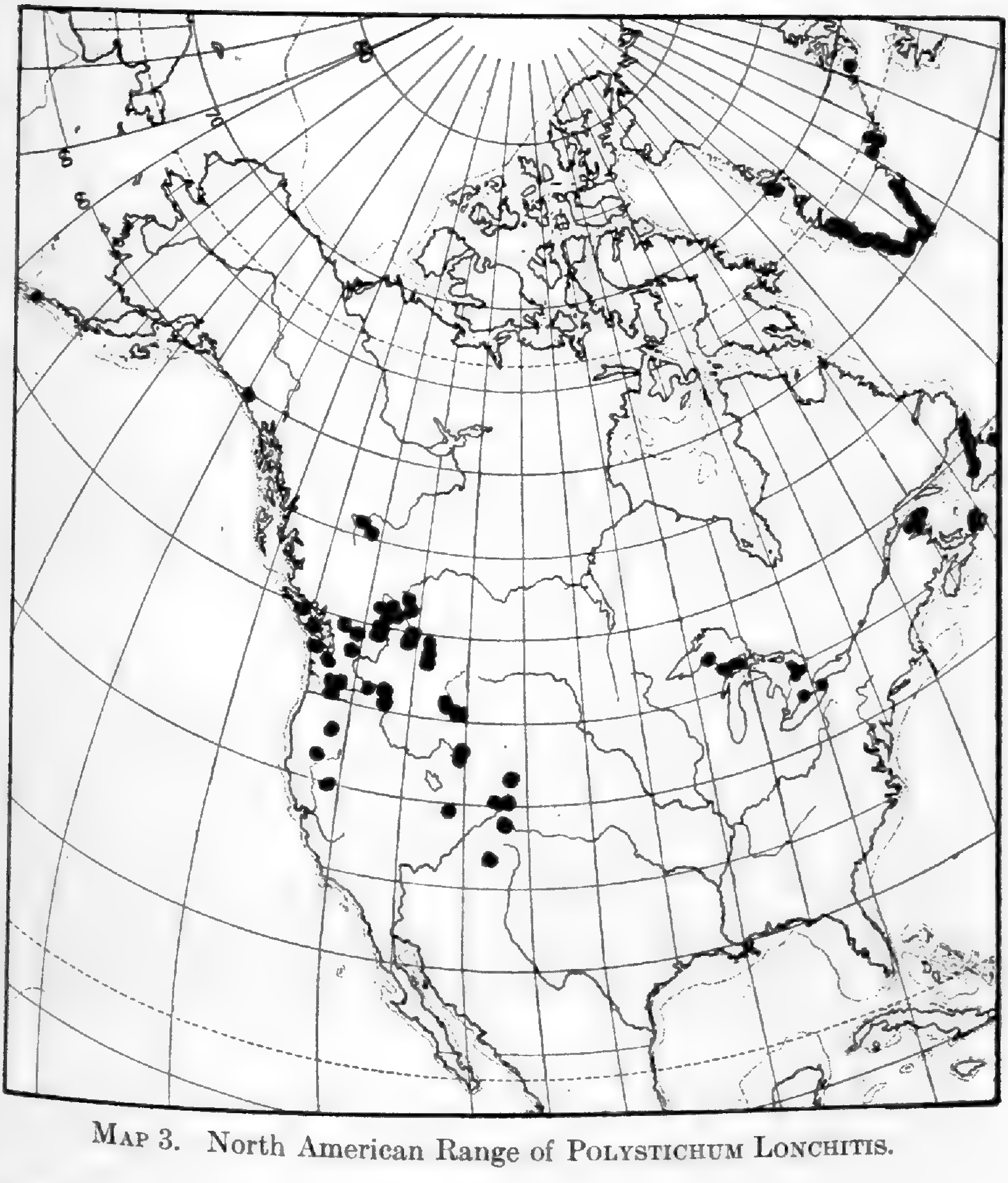
glacier which is often said to be as extensive as any which formerly occupied the median latitudes of North America. It should further be noted that, of the whole vascular flora of Greenland essentially one-third (131) of the species likewise grow as usually common plants in Michigan, Wisconsin, Minnesota or adjacent Ontario. This large (surprisingly large to those who have not previously realized it) group of temperate species, which in Greenland are not seriously disturbed by the proximity of a continental glaciation, includes such very familiar plants as *Woodsia ilvensis, Cystopteris fragilis, Thelypteris Phegopteris* and *Dryopteris, Equisetum arvense* and *sylvaticum, Lycopodium annotinum, clavatum* and *complanatum, Sparganium angustifolium, Potamogeton pusillus, gramineus* and *filiformis, Triglochin palustris, Trisetum spicatum, Deschampsia flexuosa, Eriophorum angustifolium, Carex brunnescens, canescens, deflexa* and *capillaris, Juncus bufonius* and *filiformis, Tofieldia minima, Habenaria hyperborea, Listera cordata, Corallorrhiza trifida, Alnus crispa, Arenaria lateriflora, Stellaria borealis, Ranunculus reptans* and *trichophyllus, Coptis groenlandica, Drosera rotundifolia, Potentilla palustris* and *tridentata, Viola Selkirkii, Epilobium angustifolium* and *palustre, Circaea alpina, Hippuris vulgaris, Cornus canadensis, Pyrola secunda, Ledum groenlandicum, Andromeda glaucophylla, Arctostaphylos Uva-Ursi, Vaccinium Oxycoccus, Menyanthes trifoliata, Utricularia intermedia, Galium triflorum* and *Linnaea borealis* var. *americana.* These are all plants which in much of temperate North America are looked upon as the dominant and progressive or rather ubiquitous species, plants which freely pioneer and readily take possession of newly available land. They have rapidly covered much of the territory which was under Wisconsin ice. They are not, therefore, in the same class as the next element of the living Greenland flora to be considered.

This is a more conservative group of species which shares Greenland with the Great Lakes area and other, usually scattered, regions of the Northern Hemisphere. In the Great Lakes region, as in most regions, they are localized or rare species, usually seeming like pre-Wisconsin relics there. They are mostly not pioneers today, but veterans. This list of conservatives contains the following: *Botrychium Lunaria* (K),[1] *Thelypteris Filix-mas* (K) and *fragrans* (K), *Polystichum Lonchitis*, MAP 3 (K), *Lycopodium Selago* (K), *Selaginella selaginoides* (K), *Phleum alpinum* (K), *Poa alpina* (K), *Carex Vahlii* (K) and *scirpoidea*

[1] The species of Greenland which occur as localized plants in Keweenaw County are indicated: (K).

(K), *Orchis rotundifolia, Polygonum viviparum* (K), *Stellaria longipes, Sagina nodosa* (K), *Ranunculus lapponicus, Braya humilis* (K), *Draba incana* (K), *Arabis Holboellii* (K), *Saxifraga aizoides, Aizoon* (K), and *tricuspidata* (K), *Pinguicula vulgaris* (K) and *Artemisia borealis* (K).

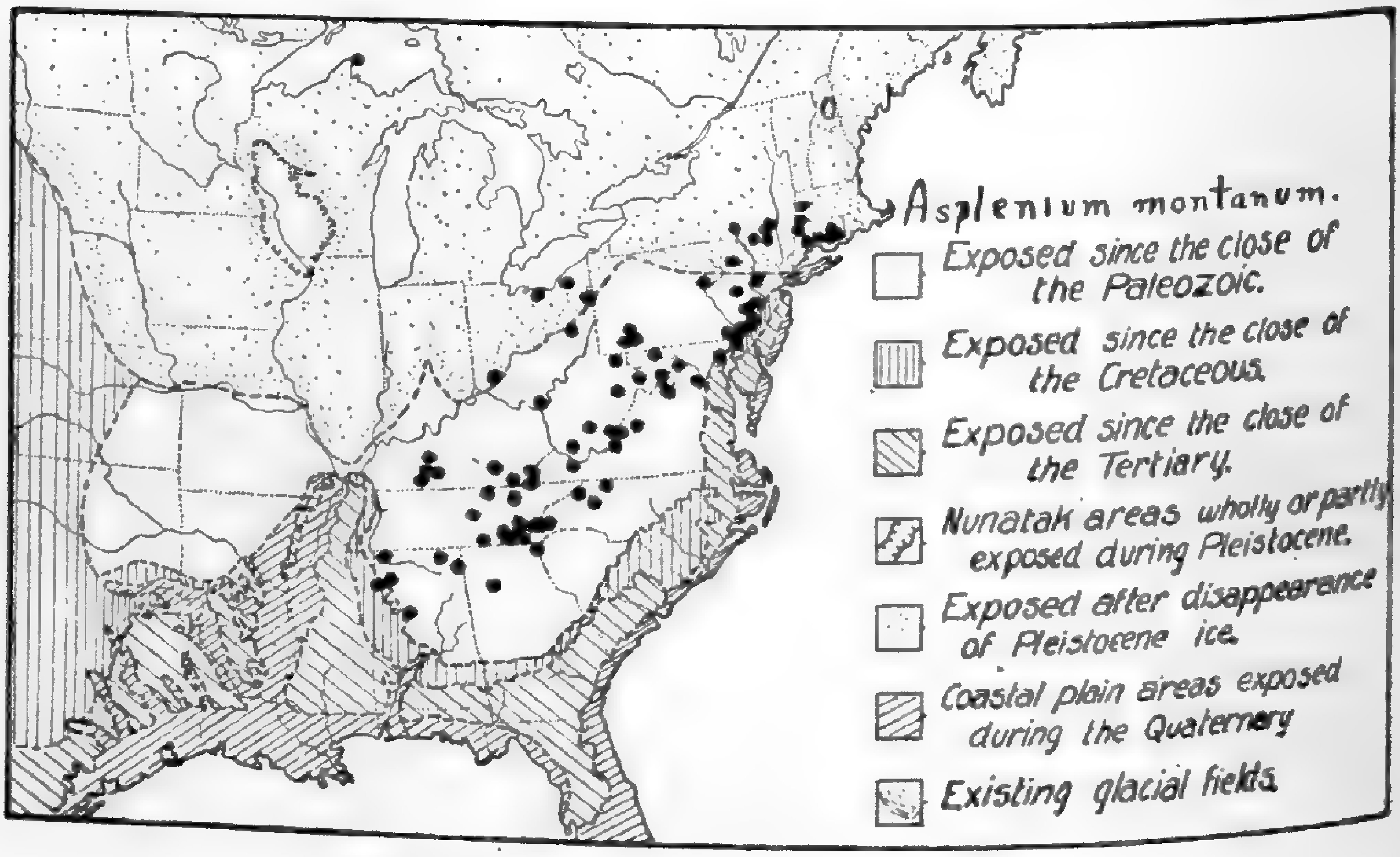
Such a very distinct and widely dispersed (ancient) but everywhere local fern as *Polystichum Lonchitis* (MAP 3), easily spread by wind-



MAP 3. North American Range of POLYSTICHUM LONCHITIS.

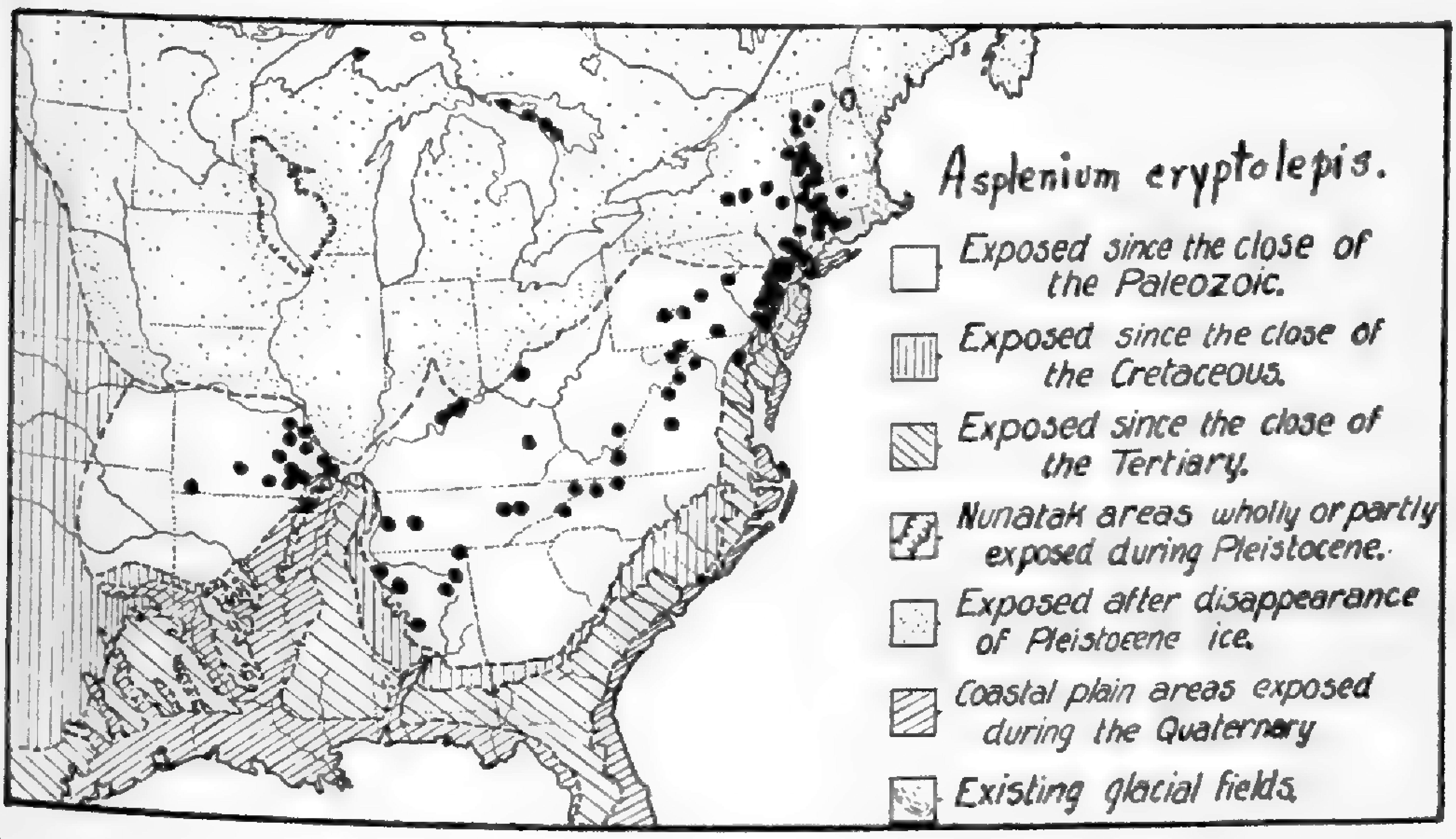
borne spores but absent (presumably exterminated by glaciations, increased aridity and other depleting agencies) from large areas within its broad belt of distribution, occurs in Keweenaw County in the richest of deciduous woods, under the shade of ancient Alleghenian trees (like *Juglans cinerea* and *Tilia americana*) with *Adenocaulon bicolor* (MAP 9), of the *Sequoia* forests of the Pacific slope and of cold ravines in the Black Hills, and *Melica Smithii* (MAP 11), also of the Pacific slope and of the Black Hills, sharing the woodland humus close-by. To me it seems quite illogical to argue that such species and the many other conservative and now unaggressive species with them have been arriving in post-Wisconsin times from different remote centers outside the area of general Pleistocene glaciation, like the Black Hills, 550 miles southwest of Lake Superior and available for plant-occupation since the Cretaceous (see MAP 1), or like the Snake River valley of Idaho, more than 1000 miles to the west and available for plant-occupation since the Jurassic. And it seems especially indefensible to maintain that such plants, coming from unglaciated or only anciently glaciated areas north, south, east and west, should fortuitously have all found the tip of Keweenaw Peninsula (or similarly isolated spots) in post-Wisconsin and should there have started successful colonies, without leaving in their long hypothetical cross-country journeys a somewhat continuous train of intermediate stations.

There is nothing particularly unique about the soils of Keweenaw County. Varying from sandstone and greenstones to silicious or to calcareous conglomerate, with frequent iron- or copper-deposits, they



MAP 4. Range of ASPLENIUM MONTANUM.

offer a fair average of diversified soils. Surely, the wind-dispersed spores of *Asplenium montanum* (MAP 4), a species of neutral to acid rock, must, during the last 30,000 years, have fallen somewhere, except locally in Ohio, between the ancient Appalachian core of the continent and the tip of this remote Peninsula; but not one of the host of ever-enthusiastic hunters for ferns has succeeded in finding an intermediate colony north of Lake Erie. Surely, *Asplenium cryptolepis* (MAP 5), an inhabitant of limestone crevices, must scatter spores on the winds every summer. Why does it shun or fail to start on the limestones between southern Ohio and central New York on one edge of its range and the Bruce Peninsula region and Keeweenaw on the

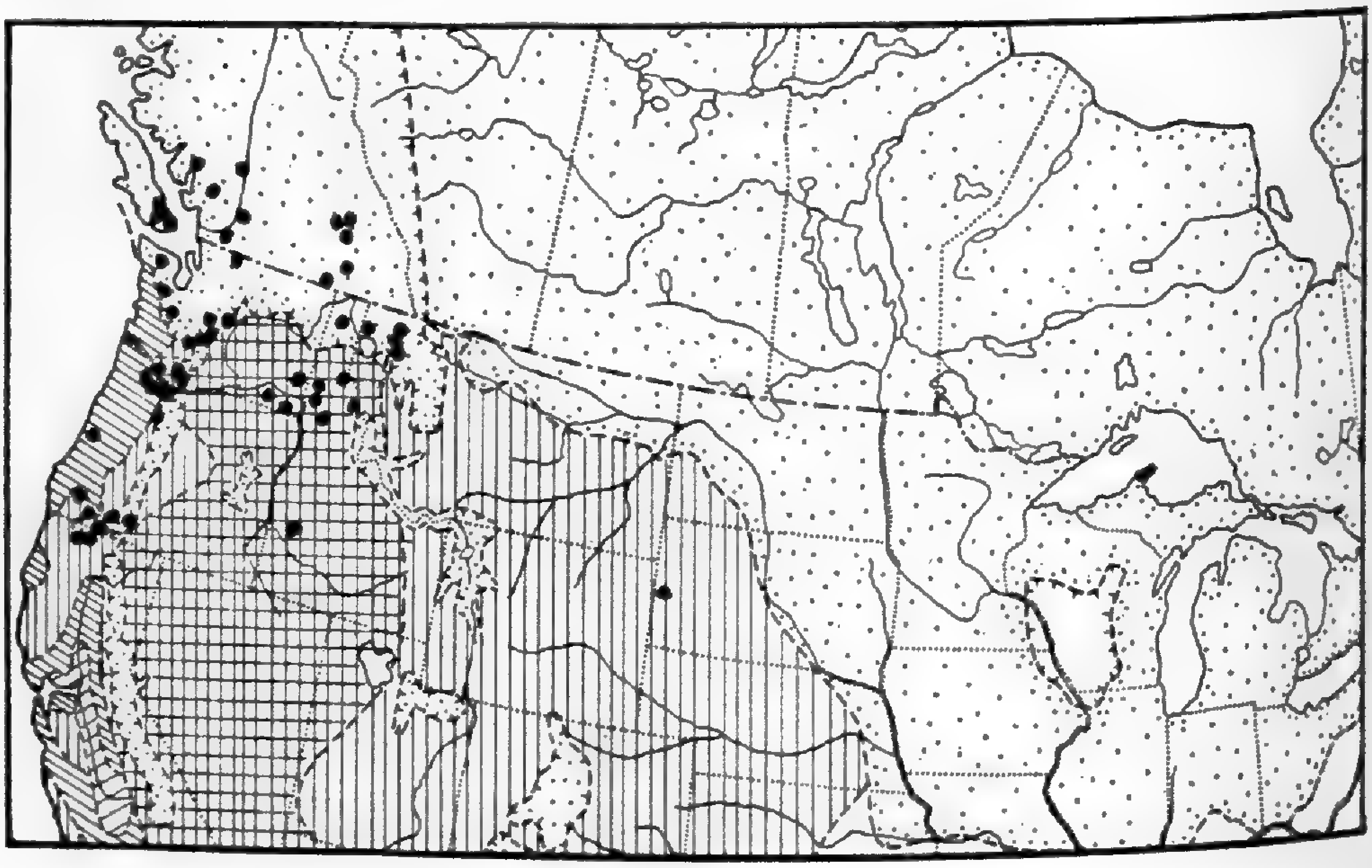


MAP 5. Range of ASPLENIUM CRYPTOLEPIS.

other? There are plenty of limestones in the broad interval but *Asplenium cryptolepis* has not been taking possession of them!

Surely, *Ceanothus sanguineus* (MAP 6), one of the most characteristic large shrubs of the Pacific slope (northern California to Vancouver Island and the Cascades of southern British Columbia, eastward across Idaho into northwestern Montana, with a single record from the Black Hills), if it migrated by means of its heavy, rounded seeds (which roll down- not up-hill) to Keweenaw County in post-Wisconsin time, could have found some dry slope or crest or arid bluff somewhere between western Montana or southwestern South Dakota and the dry bluffs and stony woods (PLATES 352 and 354) of Keewenaw where it grows. It is a tall and handsome shrub, generally known in the Northwest as "Wild Lilac." Why has it not been generally found between western Montana and Keweenaw, if, as some would have us imagine, it has been rolling its large seeds up and over the Rocky Mountains and across the Plains in search of Keweenaw Point in post-Wisconsin time?

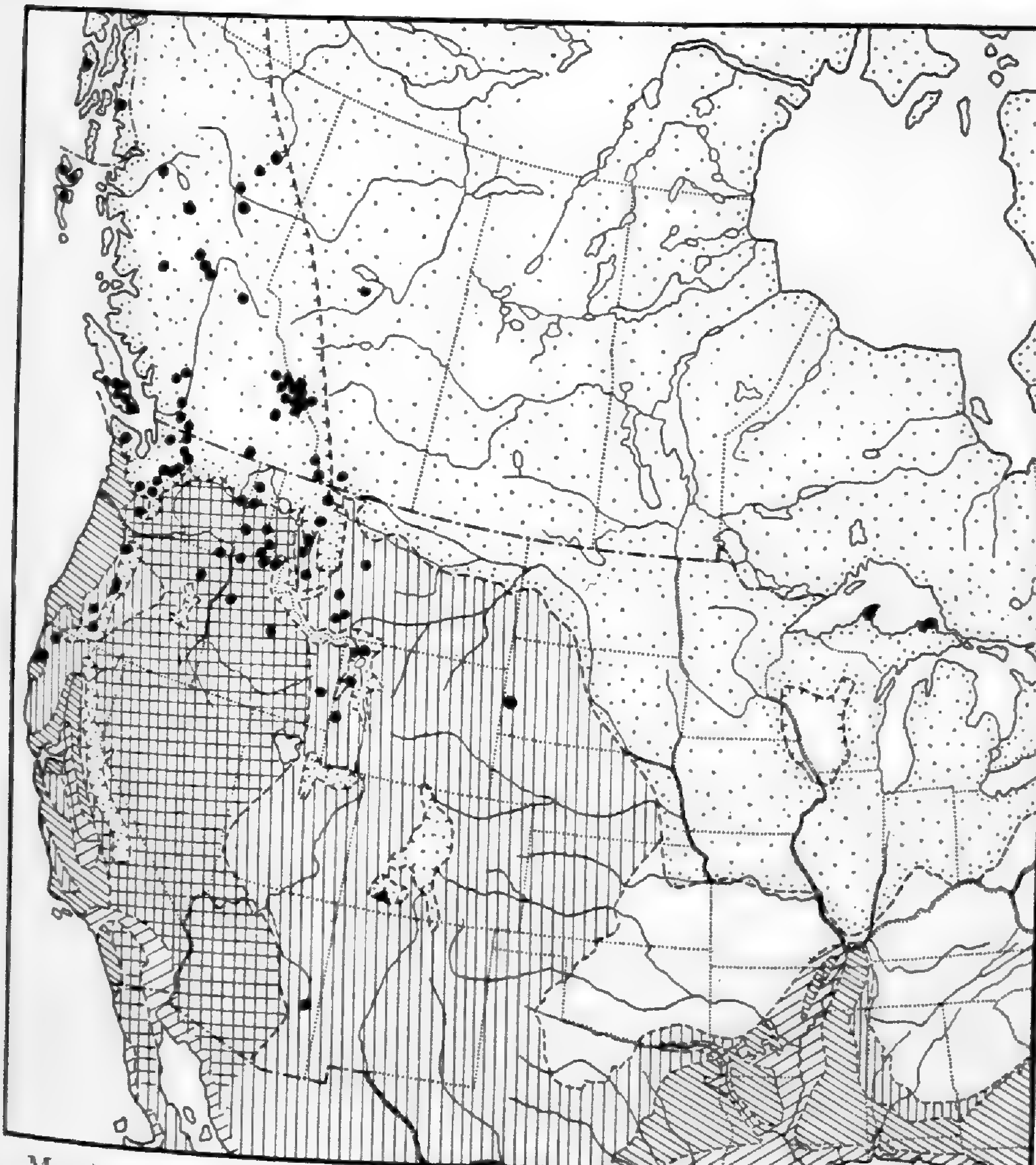
Or take *Vaccinium membranaceum* (MAP 7), the "Huckleberry" of the Upper Peninsula of Michigan and especially of Keweenaw. It is there that it is gathered and made into the conserve which reaches the fashionable tables of Great Lakes cities. Having edible berries, it is doubtless locally spread by various animals in northern Michigan. But west of there it is known in typical form (the one in Michigan) only beyond the continental divide. If it is a post-Wisconsin arrival in northern Michigan why, during its imagined migration from west of the Rocky Mountain axis, did it fail to find some place to occupy



MAP 6. Range of CEANOTHUS SANGUINEUS.

before it reached Lake Superior? It has a xerophytic smaller-leaved variety (sometimes considered a different species, *V. globulare* Rydb.) localized in the Rocky Mountains, south to Arizona; but east of the Rockies and the Black Hills it is quite unknown (and as a shrub bearing edible berries it would be known if present) except on the Upper Peninsula. It there abounds in the dry woods and on slopes of such areas as shown in PLATES 352 and 354.

Adenocaulon (MAP 8) is a genus very much older than the Wisconsin glaciation. It has five or six species: *A. adhaerescens* Maxim. and *A. himalaicum* Edgew. of the ancient floras of eastern and south-central Asia; *A. chilense* Lessing, of Chile, and possibly a second Chilean species; a recently discovered species in the mountains of Guatemala (*fide* S. F. Blake); and *A. bicolor* Hook. *Adenocaulon bicolor* (MAP 9), the North American representative of this ancient genus, has three areas: from California to southern British Columbia, eastward to northwestern Montana; valleys of the Black Hills; and from northern Minnesota to the Bruce Peninsula. It belongs in a family which has many modern weeds; but in a tribe (*Inuleae*) which has a remarkable



MAP 7. Range of VACCINIUM MEMBRANACEUM; the small-leaved variety (*V. globulare*) in the Rocky Mountains.

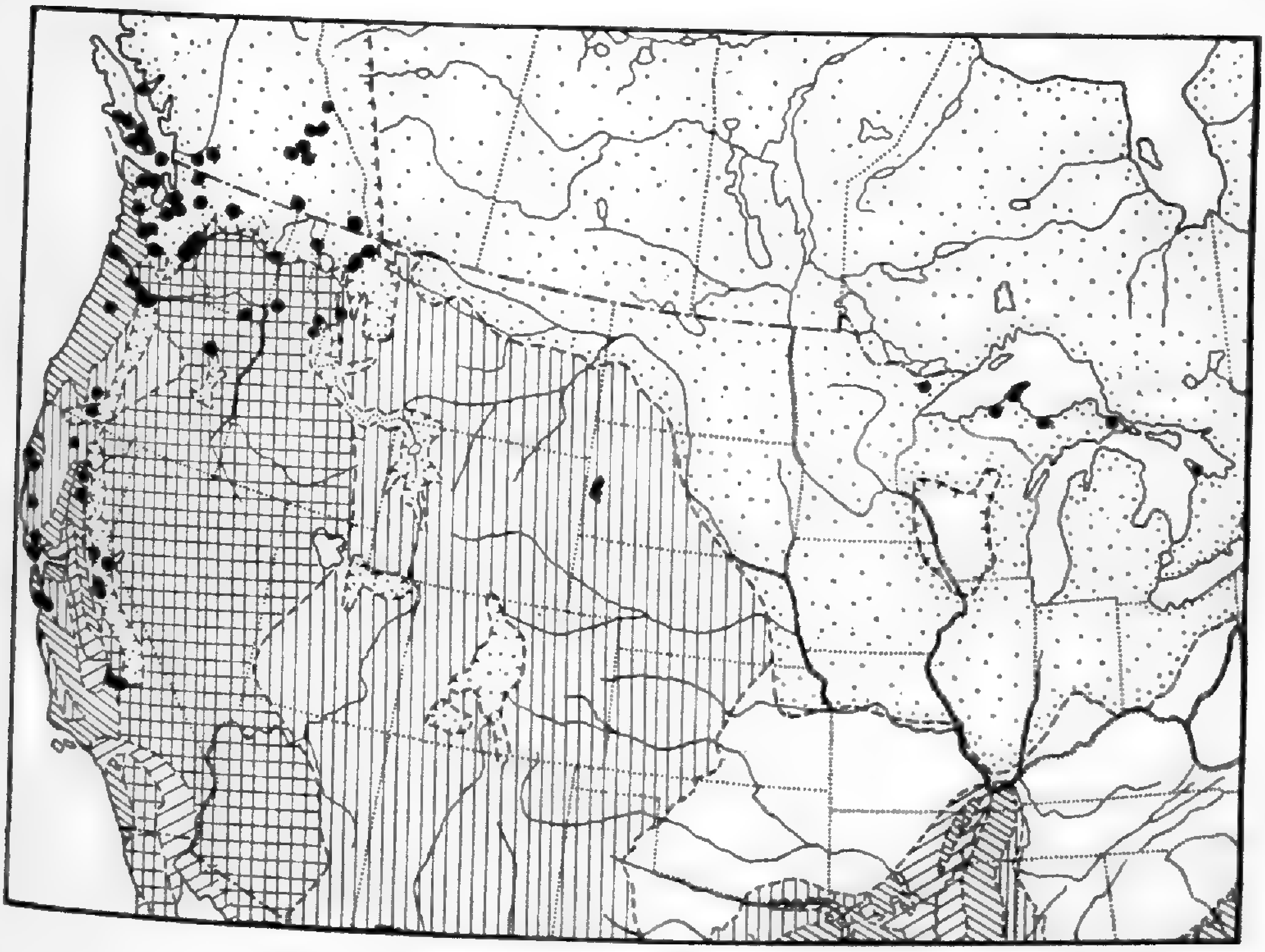
percentage of local endemics (species of *Antennaria, Leontopodium,* etc.). It is most emphatically not a weed. The geographic disruption of the genus indicates that it is comparatively old; and it is certainly significant that many of the Californian labels indicate its habitat there as being frequently under redwoods ("among redwoods," "Mariposa Big Trees," "*Sequoia gigantea* region," "among redwoods"), that Gray, in the *Botany of California,* should have given its habitat

Map 8. Range of the Genus Adenocaulon.

as "Redwoods," and that Greene, in *Flora Franciscana,* should explicitly describe its habitat as "Redwood forests of the Coast Range." It also grows in other forests, but its frequent association with ancient *Sequoia* and its occurrence on the Pacific Slope or in the Black Hills, largely in areas which had their present floras developed in pre-Pleistocene time, indicate that it is a plant of early, rather than of post-Wisconsin dispersal. *Adenocaulon bicolor* has achenes with one of the best adaptations for easy dispersal, glandular processes; nevertheless, it has failed to occupy any of the broad area between northwestern Montana and the Lake Superior-Bruce Peninsula country, except the ancient Black Hills, where Over records it as "rare in moist ravines."

If it be said that *Adenocaulon* requires moist woodland and, therefore, was unable to get a start in the broad areas between the continental divide and the Black Hills, and thence to Lake Superior, it may be pointed out that one of its associates in Pacific Slope-Great Lakes disruption of range, the "Salmon Berry" of the West, the

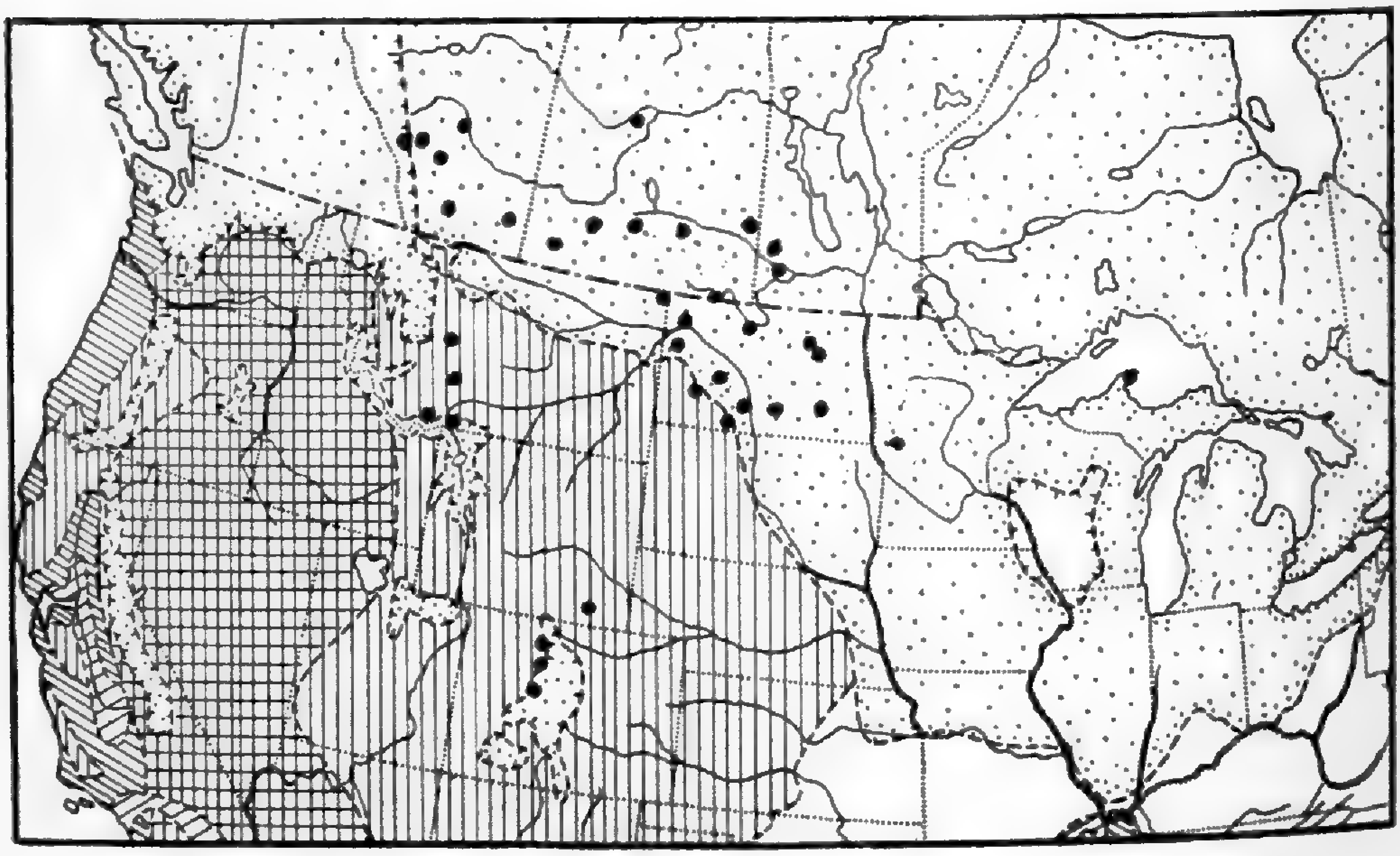
"Thimble-berry" of Lake Superior, *Rubus parviflorus* (MAPS 14–22, PLATES 363–365), has cordilleran varieties in cool and damp forested cañons all along the Rocky Mountains into Mexico, as well as in the Black Hills. And it certainly cannot be said that *Ceanothus sanguineus, Asplenium montanum* and *A. cryptolepis* are intolerant of some aridity; and surely *Chamaerhodos Nuttallii* (MAP 10, PLATE 366), which occupies the arid and windswept crests, crevices and talus of West



MAP 9. Range of ADENOCAULON BICOLOR.

Bluff, along with the cordilleran *Carex Rossii* Boott, *Woodsia oregana, Collinsia parviflora* and several other western types, is a xerophyte, and so is the misnamed *Potentilla pensylvanica* of the Cordillera and the Great Plains, growing with them. The type of *Chamaerhodos Nuttallii* came from "the highest gravelly hills" of the Mandan region; but the Keweenaw plant, also of "the highest gravelly hills," has been long enough isolated from the nearest area of the species (375 miles to the west, in western Minnesota) to have developed a marked varietal difference (PLATE 366).

The fixing of such a difference requires time, much more time than many modern laboratory experimenters imagine; and, certainly, the complete morphological segregation of a species from its geographically remote allies takes, except in the cases of hybrid-blends, a time much longer than post-Wisconsin. In the ancient and long-weathered mantle shown in PLATE 354 we find *Ceanothus sanguineus*, *Collinsia parviflora* and several other isolated plants; but in the shaded gravel near-by the most interesting plant is an undescribed and very distinct



MAP 10. Range of CHAMAERHODOS NUTTALLII; var. KEWEENAWENSIS on Keweenaw Peninsula.

Arnica (PLATE 380), which is related only to a series of cordilleran species. Its nearest relative, *A. cordifolia* Hook., is unknown east of the Black Hills; the other members of the § *Cordifoliae*, as recognized by Rydberg (N. Am. Fl.) are restricted to the mountains from Alberta to Utah and westward.

One of the most elementary principles of the history of vegetation is that the species which make up the natural associations of plants successfully migrate together, not helter-skelter, into country favorable to them and, once occupying the territory, make "closed associations," *i. e.* they take such possession that later invaders have no entry, except as the natural and primitive habitat is disturbed (by clearing, plowing, land-slides, etc.). It will be noted from the maps that the western types which are isolated about the Upper Great Lakes are, in the Black Hills, in the Rocky Mountains or on the Pacific slope (south of north-central Washington, northern Idaho and northern Montana), in country which they undoubtedly occupied before Pleistocene time. They extend northward slightly into the region of the Cordilleran glaciation. The latter region, however, was unquestionably quite as available to plant-occupation in the Pleistocene as are the ice-free forelands and cliffs of Greenland and Novaya Zemlya today. Here are the words of Chamberlain and Salisbury: "The whole Cordilleran ice-sheet was the product of a confluence of mountain glaciers deploying on the intervening plateau; but there appears to have been plateau glaciation not solely dependent on contributions of ice from the mountains. . . . The northern lobes descended the valleys tributary to the Yukon. . . . On the west, the plateau ice-cap seems to have sent tongues of ice through the gaps in the coast ranges at many points, and to have discharged thence into the Pacific. . . . Much the greater part of the 4,000,000 square miles of the ice-fields lay on the plains of Canada and in the upper Mississippi valley."[1] There is no more reason to suppose that the plants of the Pacific slope under discussion have invaded southern British Columbia since the waning of the Pleistocene valley- and plateau-glaciers than there would be to insist that Ellesmereland, Greenland, Spitzbergen, Novaya Zemlya, Switzerland, Glacier National Park, the Malaspina Glacier (covered with heavy forest) and the valleys of southern New Zealand are now destitute of vegetation. Everyone knows that they are not so.

Consequently, the occurrence of such plants on the Keweenaw Peninsula, in or adjacent to habitats where there are no obvious glacial drift or large transported boulders and where the long-continued subaerial weathering has produced a loose carpet or crust of angular gravel *in situ*, forces me to the conclusion that this region, like some others about the Upper Great Lakes, did not suffer a complete extermination of its flora in the Pleistocene, at least during the later glacial developments called the Wisconsin glaciation. In 1925, still retaining a naïve faith in what I had been taught but realizing that the considerable relic-flora about the Upper Great Lakes needed explanation, I wrote: "All geologists whom the author has consulted are in agreement, that the shores of the Great Lakes were all eroded or covered in the Wisconsin glaciation and even that some of the region (Isle Royale, for example) has been submerged beneath the surface of the lakes. It would, therefore, be hardly justifiable to account for these plants of the Pacific slope isolated on Isle Royale, Isle St. Ignace, Keweenaw Peninsula or Bruce Peninsula, as relics which there outlived the Wisconsin glaciation."[2] I then suggested

[1] Chamberlain & Salisbury, Earth Hist. iii. 330–333 (1906).
[2] Fernald, *Persistence of Plants in Unglaciated Areas of Boreal America*, Mem. Amer. Acad. xv. (Mem. Gray Herb. ii). 317 (1925).

that they might have survived in the Driftless Area to the southwest and thence later migrated to Lake Superior.

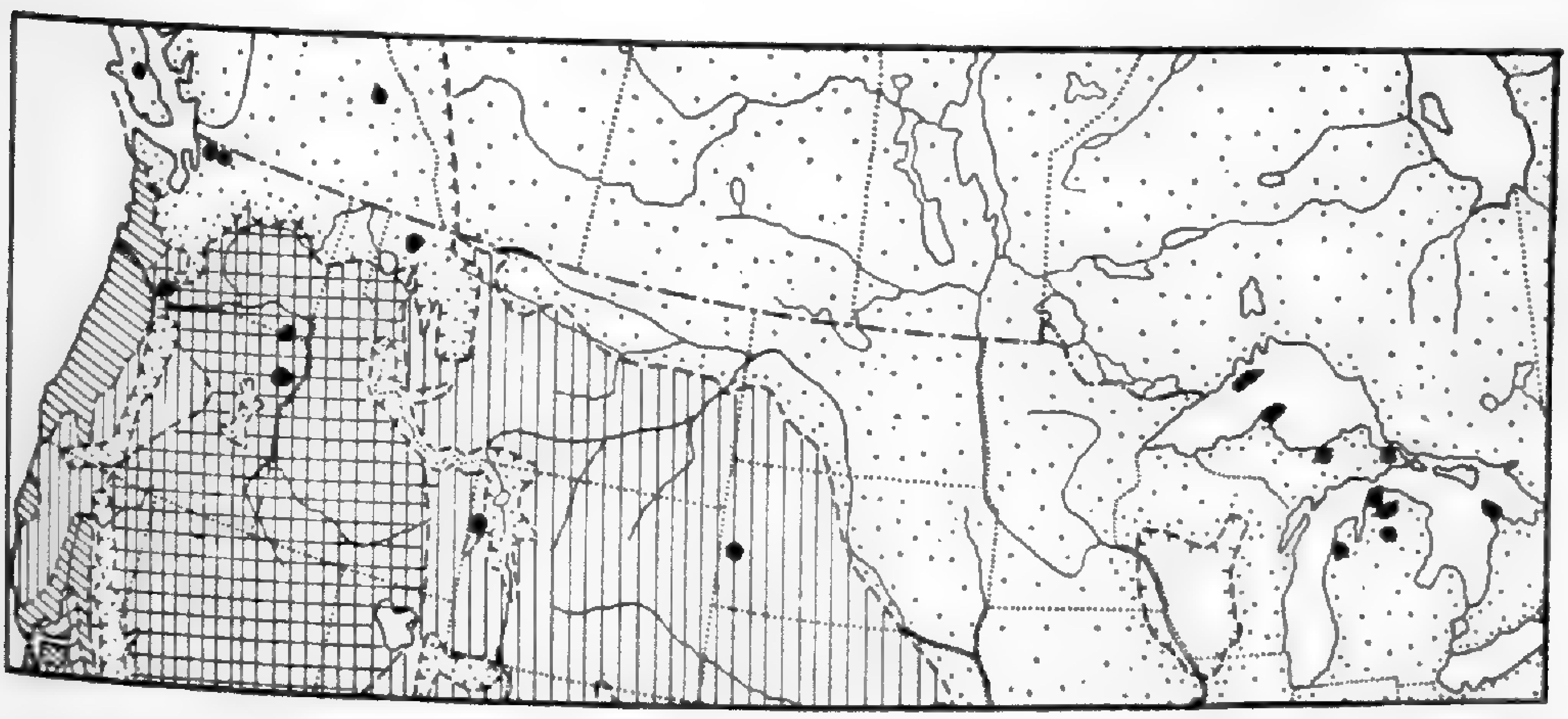
Fassett,[1] however, finds it difficult to conceive several of the isolated species of northern Michigan and northern Wisconsin (*Rubus parviflorus, Arenaria macrophylla, Goodyera decipiens, Osmorhiza divaricata,* etc.) as having been in The Driftless Area without leaving colonies in habitats there which would be favorable for them. Fassett continues: "The apparently preglacial flora of northern Wisconsin and neighboring territory has its affinities with the Rocky Mountains, with the Gaspé Peninsula, and with the Torngat Mountains. There is another relic flora in The Driftless Area . . . which has its affinities mostly with the region south of the area of Wisconsin glaciation. . . . This distinct relic flora, practically confined to The Driftless Area, with several endemics, having its affinities in unglaciated areas to the westward or to the southeastward, may be clearly interpreted on the basis of lack of glaciation in southwestern Wisconsin. But the occurrence in the Lake Superior region of plants of the Rocky Mountains and of the Gulf of St. Lawrence area is a problem that cannot at the present be solved with any degree of certainty."

Our experience in Keweenaw County leads us to the belief that Fassett's contention is well founded and that the isolation of plants in the Lake Superior region, some from the Rocky Mountains or the Black Hills (or from the Gaspé region), some from the arid high Plains, some from the Ozarkain and Appalachian plateaus (but none, I think, with distinctive Torngat relationship, except species of broad boreal dispersal), does not require the Pleistocene invasion by them of The Driftless Area The Driftless Area (with emphasis on THE) was not the only haven in the Great Lakes region during the Wisconsin glaciations. The high bluffs of Keweenaw evidently were not denuded by Wisconsin ice and, consequently, they served as centers on which many species survived (just as hundreds of species are living today on the available slopes and ice-free forelands of Greenland or of Novaya Zemlya), some later to spread slightly to lower levels and, in case of readily dispersed species, like *Rubus parviflorus* (MAPS 14–22), *Vaccinium ovalifolium* and *membranaceum* (MAP 7), *Osmorhiza divaricata, Goodyera decipiens, Melica Smithii* (MAP 11), *Festuca occidentalis* and *Adenocaulon bicolor* (MAP 9), to extend over much of the Upper Lakes region, while annuals, such as *Polygonum Douglasii, Epilobium paniculatum* and *Collinsia parviflora,* tend to become local weeds.

[1] Fassett, RHODORA, xxxiii. 226, 227 (1931).

Other species, such as *Asplenium montanum* (MAP 4) and *cryptolepis* (MAP 5), *Carex Rossii*, *Ceanothus sanguineus* (MAP 6), *Chamaerhodos Nuttallii* (MAP 10), *Potentilla Blaschkiana* and the endemic *Arnica*, have apparently not spread far or at all from their old havens.

These observations on the Keweenaw Peninsula inevitably suggest that similar conditions will be found in other sections of the Upper Great Lakes area, especially where elevated and vertical escarpments and sharp bluffs stand high above the general level.[1] So long as the botanist meekly accepts, without personally checking, the proposition that *all* the Upper Great Lakes region was completely under Wisconsin ice (and to a depth sometimes said to be 2,000 feet!) and then under the water of the Lakes he will fail to solve this striking



MAP 11. Range of MELICA SMITHII.

phytogeographic problem. If he will visit the high bluffs and escarpments and himself SEE the conditions, he is likely to find that the bluffs of Keweenaw are not alone in lacking the abundant transported drift with which orthodox geology has blanketed them. He is likely to find that their crests and slopes have, instead, a rotted and angular crust or deeply weathered mantle *in situ*. It will then be demonstrated that there were in the Upper Great Lakes region SEVERAL DRIFTLESS AREAS, limited in extent but sufficient to have maintained colonies of the formerly wide-spread and somewhat generalized Tertiary flora, species which, in areas of active Wisconsin glaciation, were eliminated in favor of a younger and more aggressive series of plants.

I realize that the current interpretation of many ecologists favors

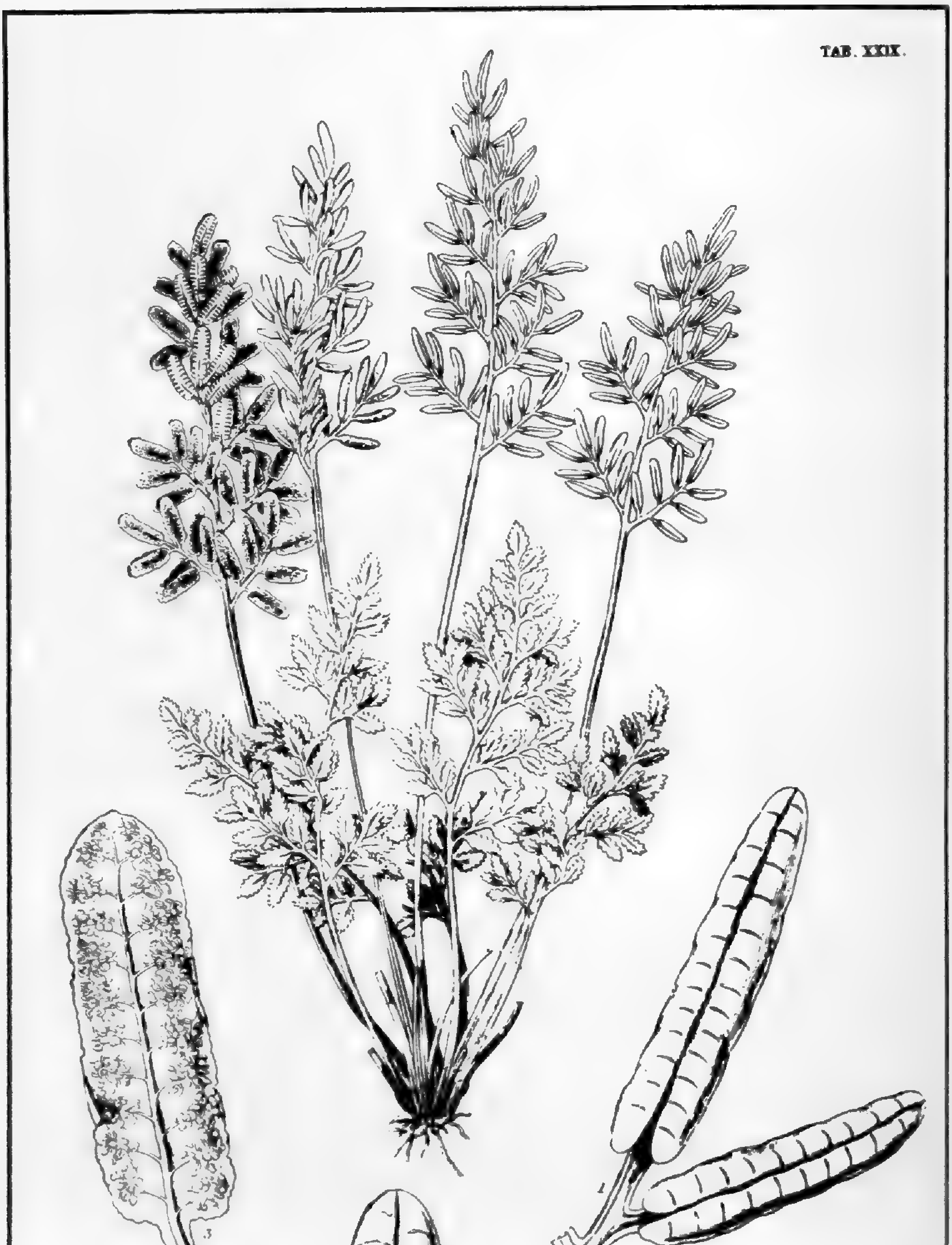
[1] One such area has been reported to me. It is hoped that its discoverers and explorers will soon give an account of it. Two others, where Wisconsin activity seems to have been slight, are awaiting examination.

an arid ("xerothermic") climate following the Wisconsin glaciation and a migration then into the areas which had been covered by Wisconsin ice of a flora which has subsequently become segregated or disrupted by a post-Wisconsin climatic change. Personally "I am from Missouri" regarding this proposition. If *Ceanothus sanguineus* (MAP 6), *Woodsia oregana, Carex Rossii* and other western xerophytes are interpreted as relics of colonies which extended across the Great Plains to Keweenaw in the reputed early arid spell, why have they so completely disappeared from the great arid stretch of Plains, with their bluffs and crests, which should now suit them? They are accompanied in Keweenaw by western mesophytes, such as *Melica Smithii* (MAP 11), *Corallorrhiza striata, Vaccinium membranaceum* (MAP 7), *Rubus parviflorus* (MAPS 14–22), *Adenocaulon bicolor* (MAP 9) and others. Would those who believe in the "xerothermic" post-Wisconsin climate maintain that these mesophytes also crossed the Plains and reached Keweenaw during their "xerothermic" stage? I cannot believe it.

Altogether these recent short excursions of New Englanders about the Upper Great Lakes have yielded many species apparently little known or hitherto unreported in the region. In so far as they are yet worked out they are here reported; and in a few instances noteworthy species, although not collected by us, are specially discussed. The photographs of the terrain and of growing *Rubus parviflorus* here reproduced were taken by HENRY G. FERNALD. The maps of ranges have been prepared by my daughter, MISS KATHARINE FERNALD, with a contribution of data from the Ozark Plateau from JULIAN A. STEYERMARK. The smaller-scale base-map used for several species was prepared for me by the geologist, ALFRED W. LOTT. It is presented in full as MAP 1, which gives the necessary explanations. The other base-map of eastern North America carries its own explanation. The world-projection used is Goode's no. 201 Pc, copyrighted by the University of Chicago. The photographs of herbarium specimens and their details have been prepared by my student and special assistant, E. C. OGDEN. The expense involved in the preparation and reproduction of the plates and maps has been met in part from the Wyeth Fund of the Division of Biology, in part through a grant from the Milton Fund for Research, both of Harvard University.

Photo. E. C. Ogden.

PHYLLITIS SCOLOPENDRIUM: FIG. 1, frond, × ½, from Ireland; FIG. 3, scales of stipe, × 10, from Ireland; FIG. 5, venation, × 10, from Savoy. Var. AMERICANA: FIG. 2, frond, × ½, from New York; FIG. 4, scales of stipe, × 10, from Ontario; FIG. 6, venation, × 10, from New York.



Cryptogramma crispa, var. acrostichoides (*C. acrostichoides*, after Hooker & Greville).

Part II. Taxonomic and Floristic Notes

In the succeeding pages all our records are entered which might prove useful to students of the local flora. Unless otherwise noted the collectors are *Fernald & Pease.*

Woodsia alpina (Bolton) S. F. Gray. Michigan: crevices and talus of greenstone and calcareous conglomerate bluffs in woods, east of Eagle Harbor, Keweenaw Co., no. 3051.

Whether this is a different station from that of Farwell I do not know.

W. oregana D. C. Eaton. Michigan: partly shaded crevices and talus of sandstone-conglomerate, West Bluff, Keweenaw Co., no. 3052. See p. 213.

C. K. Dodge, in his *Fern Flora of Michigan,* Fern. Bull. xx. 13 (1912), cited "South shore of Lake Superior," which was derived from the old collection of Robbins. This record, which was started in this form by D. C. Eaton in Gray, Man. ed. 5: 669 (1867), appeared as "the Keweenaw Peninsula" in Eaton, Ferns N. Am. ii. 185 (1880). The late C. F. Wheeler got it on the Menominee River (McAtee, Pap. Mich. Acad. i. 160).

Pteretis nodulosa (Michx.) Nieuwl., f. **pubescens** (Terry), comb. nov. *Struthiopteris germanica,* f. *pubescens* Terry, Fern. Bull. xvi. 5 (1908) inadvertently misnamed but corrected on p. 49 (1908). *S. germanica,* var. *pubescens* (Terry) A. A. Eaton, Fern. Bull. xvi. 47 (1908). *S. pubescens* (Terry) Clute, Fern. Bull. xvi. 48 (1908). *S. pennsylvanica,* f. *pubescens* (Terry) Clute, l. c. (1908). *Matteuccia pubescens* (Terry) Clute, l. c. (1908). *M. Struthiopteris,* f. *pubescens* (Terry) Clute, l. c. (1908). *M. Struthiopteris,* var. *pubescens* (Terry) Clute, l. c. (1908).

This very striking form, with canescent-tomentulose, instead of glabrous and lustrous rachis, abounds in rich deciduous woods near Mohawk, Keweenaw Co., Michigan, no. 3053.

The form of the ordinary Ostrich Fern with fertile fronds approaching the sterile in form is

P. nodulosa, f. **obtusilobata** (Clute), comb. nov. *Onoclea Struthiopteris,* f. *obtusilobata* Clute, Fern. Bull. xviii. 111 (1910). *Struthiopteris germanica,* f. *obtusilobata* Clute, l. c. (1910).

Thelypteris Robertiana (Hoffm.) Slosson. *Phegopteris Robertiana* (Hoffm.) A. Br. Michigan: wooded slope, talus of limestone cliff, Burnt Bluff, Delta Co., no. 3044.

Recorded by Gates & Ehlers from Cheboygan Co. (Pap. Mich. Acad. xiii. 68).

T. fragrans (L.) Nieuwl., var. Hookeriana Fern. To the Ontario and Michigan stations recorded by me in Rhodora, xxv. 4 (1923) the following, represented in the Gray Herbarium, may be added. Ontario: cliff slide, Devil's Mt., Timagami Region, *E. & D. M. Anderson*, no. 26,009B; cliffs, South Slate Island, Thunder Bay District, *Pease & Bean*, no. 23,447. Michigan: crevices and talus of greenstone bluffs in dry woods near Cliff, Keweenaw Co., no. 3045; crevices and talus of greenstone and calcareous conglomerate bluffs in woods, east of Eagle Harbor, Keweenaw Co., no. 3046; seen on several other cliffs in Keweenaw Co.

Polystichum Lonchitis (L.) Roth. Dodge merely repeats the statement from Beal's Michigan Flora (1904): "Woods south shore of Lake Superior, Prof. Whitney; Keweenaw Co., O. A. Farwell." The following Michigan specimens are in the Gray Herbarium: Lake Superior, Upper Michigan, *State Collection;* south shore of Lake Superior, *C. T. Jackson;* rocky woods, southern shore of Lake Superior, 1863, *Robbins;* Clifton, Keweenaw Co., August, 1885, *T. E. Boyce;* rich, deciduous woods, Delaware, Keweenaw Co., no. 3041; Houghton, *Pammel & Fisk*, no. 457; rocks near Chatham, Alger Co., August 29, 1900, *C. F. Wheeler*. See p. 207 and map 3.

P. Braunii (Spenner) Fée, var. Purshii Fern. The westernmost stations represented in the Gray Herbarium are the following. Ontario: rich wooded bank near Agawa River, Agawa Bay, Algoma District, *Pease*, no. 17,964. Michigan: south shore of Lake Superior, 1849, *Whitney;* woods, Keweenaw Peninsula, 1863, *Robbins*, 1888, *Farwell*, no. 617; rich, deciduous woods near Mohawk, Keweenaw Co., no. 3043; rich deciduous woods above Miner's Falls, near Munising, Alger Co., no. 3042.

Phyllitis Scolopendrium (L.) Newm., var. **americana**, var. nov. (tab. 355, figs. 2, 4, et 6), squamis stipitis tenuissimis longe caudatis flexuosis; frondibus plerumque supra medium fructiferis; indusiis lineari-oblongis longioribus 0.3–2.2 (av. 1.25) cm. longis; costis plerumque glabratis; foveolis lineari-oblanceolatis vix marginalibus.—Highly localized in New Brunswick, New York, Ontario and Tennessee. Type: abundant in horizontal seams of dolomite in deciduous woods, Ingalls Falls, Grey Co., Ontario, June 19, 1934, *M. L. Fernald* (with R. B. Thomson and J. G. Wright), no. 3040 (in Gray Herb.). See p. 201 and map 2.

The Hart's Tongue of eastern North America is famous and much discussed on account of its extreme localization: St. John Valley, near Woodstock, New Brunswick (station perhaps destroyed); local stations in Madison County and larger ones (one of them destroyed) in Onondaga County, New York; frequent stations on the dolomite of Grey, Durham and Bruce Counties, Ontario; and a limestone sink-hole in Marion County, Tennessee. The nearly 40 collections of it in the Gray Herbarium show it to average a much smaller plant than the European, with less numerous and shorter indusia, with the delicate curling scales of the stipe all long-caudate and linear-filiform, without the broader and flatter lance- or linear-attenuate scales which occur in the European; the midrib more promptly glabrate; the fronds usually fruiting only in the upper half instead of nearly or quite their full length; the indusia averaging much shorter and the foveolae (enlarged tips of veinlets) more elongate and farther from the margin than in the European. The specifications follow:

67 fronds of the European plant give a range in length of 0.9–6 (AVERAGE 3) DM.; 67 fronds of the North American a range in length of 1.1–3.4 (AVERAGE 2.3) DM. 57 fertile fronds of the European plants show the indusia to occupy 33–100 (AVERAGE 73) PERCENT of the total length of the frond; 65 fertile fronds of the American plant giving an AVERAGE OF 54 PERCENT. Expressed in another way, the length of the fruiting portion in the European gives an AVERAGE OF 2.1 DM.; in the American OF 1.3 DM. The indusia are variable in length on the same frond, sometimes tolerably uniform, sometimes with short ones of various lengths alternating with the longer. Measuring the longest on each frond we get the longest indusia in the European series 0.7–3.3 (AVERAGE 1.7) CM. LONG; in the American 0.3–2.2 (AVERAGE 1.2) CM. LONG. The foveolae (enlarged tips of the veinlets), seen by transmitted light, in the European plant are elliptic and nearly marginal in the frond; in the American plant they are more slender and end a little farther from the margin. These points are well displayed in PLATE 355, showing a small frond of European *Phyllitis Scolopendrium* on the left (FIG. 1), of var. *americana* on the right (FIG. 2), with enlargements, × 10, of the stipes (to show the chaff) and of the foveolae added as inserts (FIGS. 3 and 5 from Euro pean specimens; FIGS. 4 and 6 from American).

The only other variation of *Phyllitis Scolopendrium* in North America is the plant of Chiapas in southern Mexico. This has the chaff *very* slender and sublanate and extending nearly the length of the midrib beneath; and the foveolae are elliptic and marginal. Although it is sometimes maintained as a species, I agree with Christ, Christensen, D. C. Eaton, Hemsley, Hooker & Baker and Milde in leaving it in *P. Scolopendrium* as a geographically isolated variety.

Var. **Lindeni** (Hook.), comb. nov. *Scolopendrium Lindeni* Hook. Ic. Pl. t. 488 (1842). *P. Lindeni* (Hook.) Maxon, Fernw. Papers, 42 (1900).

For discussion and map of the inclusive *Phyllitis Scolopendrium* see p. 201 and MAP 2.

Pellaea atropurpurea (L.) Link. Michigan: wind-swept crests, crevices and talus of sandstone-conglomerate, West Bluff, Keweenaw County, no. 3035.

It is not possible, without seeing the material, to be certain whether the only record for Michigan (Norway, Dickinson Co.) given by Dodge belongs to this or the next.

P. glabella Mett. Michigan: crevices and talus of limestone cliff, Burnt Bluff, Delta Co., no. 3034.

Cryptogramma Stelleri (Gmel.) Prantl. Probably more frequent on the Upper Peninsula of Michigan than indicated by the one indefinite and the one definite locality cited by Dodge. We twice collected it in Michigan: cliffs about Miner's Falls, near Munising, Alger Co., no. 3036; limestone escarpment in woods south of Garden Delta Co., no. 3037.

(*To be continued*)

CRITICAL PLANTS OF THE UPPER GREAT LAKES REGION OF ONTARIO AND MICHIGAN

M. L. Fernald

(*Continued from page 222*)

Cryptogramma crispa and C. acrostichoides (Plates 356 and 357).—Having occasion to check as closely as possible the range of the dimorphic fern which in America passes as *Cryptogramma acrostichoides* R. Br. I have become increasingly perplexed to find satisfactory characters to separate it as a species from the European *C. crispa* (L.) R. Br. and the Asiatic *C. Brunoniana* Wallich.

The difficulty is an old one. Robert Brown set up the genus *Cryptogramma*, basing it on the plant brought back by Richardson from the Nelson or the Mackenzie drainage-systems: "In shady rocky woods, between lat. 56° and 60° north. (First found by Mr. Menzies at Nootka Sound)"[1]; but he also included doubtfully with it in the genus the *Pteris crispa* (L.) All., the plant now called *C. crispa* (L.) R. Br. and confined to Europe and adjacent Asia, saying that the European plant differs in having the sori shorter and more rounded, the American with them linear: "Typus generis est Cryptogramma acrostichoides, sed character constructus pro receptione Pteridis crispae *auctor.* quae equidem species, ob soros abbreviatos potius subrotundos quam lineares, venulas terminantes sinum feré involcri occupantes et cito confluentes, tunc aemulantes sorum linearem continuum costae parallelum Pteridis, cum cujus speciebus pinnulis angustatis involucro omnino tectis, habitu bené satis convenit." Kaulfuss, in 1824, reduced *Cryptogtramma acrostichoides*, with doubt, to *Allosorus crispus* (L.) Bernh., basing his reduction on examination of Chamisso's material from Unalaska.

In 1829 Hooker republished Brown's account of *Cryptogramma acrostichoides*, citing first the Menzies collection from Nootka Sound, followed by that of Richardson from the Nelson or the Mackenzie area, and showing typical *C. acrostichoides* in one of Greville's beautiful plates,[2] here reproduced as our plate 356. Referring to Robert Brown's doubt as to the generic identity of the American and the European plants, Hooker said: "To us, however, there appears no generic difference; and the fertile fronds have the closest similarity, in almost every particular, except in the rather shorter *sori* of *capsules*.

[1] R. Br. in Richardson, Frankl. Journ. App. ed 1: 754, repr. 26, and 767, repr. 39 (1823).

[2] Hook. & Grev. Ic. Fil. i. t. xxix (1829).

In the sterile fronds the pinnules are much broader and never wedge-shaped, in the plant [*C. acrostichoides*] now before us."

Two years later, with a plate (t. clviii), here reproduced as our PLATE 357, Hooker took up a manuscript name of Wallich's for a plant of alpine summits of the Himalayas and published as a new species *Cryptogramma Brunoniana*.[1] The plate of it (our PLATE 357), except for the right-hand sterile frond, might have been drawn from the type-collection of *C. acrostichoides* (our PLATE 356). Note the very similar pinnules of the sterile frond on the left, of *C. Brunoniana*, and those of the Greville plate of *C. acrostichoides*, the essentially identical fertile fronds, the venation of the inrolled pinnules, the enlarged sori and the spores. Although Hooker, following Wallich, intended to compliment Robert Brown in the specific name, the dedication had mixed values:

> Amongst the extensive and valuable collection . . . made by Dr. Wallich . . . , few have given us more pleasure than a species of *Cryptogramma*,—the subject of the present plate,—which was detected on the lofty "Kumaun," a part of the great range of the Himala mountains, by Robert Blinkworth. . . . And this too, though from so very remote a country, is yet *almost* identical with that of Nootka Sound and Subarctic America. The only difference exists in the sterile fronds . . .
>
> Dr. Wallich accompanied the specimens with the remark, "Dedicavi speciem conditori generis immortali, amico aestimatissimo": and we think ourselves honoured in being permitted to give publicity to so interesting a plant, which bears the name of the greatest Botanist of this or any other age or country.

Hooker's dedication, recalling Humboldt's gracious tribute to Robert Brown as "botanicorum facile princeps" everyone could applaud; but, unfortunately, the specific value of *Cryptogramma Brunoniana* was soon doubted by Hooker himself. In his most scholarly work on the ferns, Species Filicum, Hooker in 1858, taking the unjustifiable liberty of changing Brown's *Cryptogramma* to *Cryptogramme*, went further. He boldly reduced both *C. acrostichoides* and *C. Brunoniana* to mere FORMS of the European *C. crispa*. His revocation of the Asiatic and the American species was clearly stated:

> In taking the bold step to unite several supposed species into one, as I have here done, contrary to the judgment of the most distinguished botanists, it is necessary that I offer explanation, especially when, in conjunction with my friend Dr. Greville (Icones Filicum), I published as distinct two of the species I propose to abolish, viz. the N. American *C. acrostichoides*, Br., and the Northern Indian *C. Brunoniana*, Wall. I would however call attention to the remark made, firstly, under *C. acro-*

[1] Wallich in Hook. & Grev. Ic. Fil. ii. t. clviii (1831).

stichoides: "Mr. Brown has drawn up the character of the genus so as to include our *Pteris crispa,* which he nevertheless considers a doubtful species of *Cryptogramme.* To us, however, there appears no generic difference; and the fertile fronds have the closest similarity in almost every particular except the shorter sori (in *C. crispa*). In the sterile fronds the pinnules are much broader, and never wedge-shaped in the plant before us (*C. acrostichoides*)." Under *C. Brunoniana* we observed, "This, though from so remote a country (Himalaya), is yet almost identical with that of Nootka Sound and subarctic America (*C. acrostichoides*); the only difference exists in the sterile fronds," &c. If indeed there was a manifest difference in the sori, so as to constitute different genera, between *C. crispa* and *C. acrostichoides* and *Brunoniana,* as Presl, and lately Mettenius, maintain is the case, the first could upon no account be united with the two latter; but I think I may appeal to the magnified representations of the sori of *C. crispa,* as given in our 'Genera Filicum' and in Fée's 'Genera Filicum,' and of those of the two kinds in the 'Icones Filicum,' in support of my views that there is no available distinction; and I have copious specimens before me at this moment of our British species (*C. crispa*), in proof that, as in *C. acrostichoides,* these sori occupy so much of the veins, and are "ita approximati, ut discus totus pinnulae explanatae capsulis maturis tectus est, et in hoc stadio filix species *Grammitidis* vel *Acrostichi* quasi evadit," *Br.* Our specimens, gathered in an advanced state in Galloway, Scotland, have the involucres quite spreading, and exposing the sori occupying nearly the whole veins.

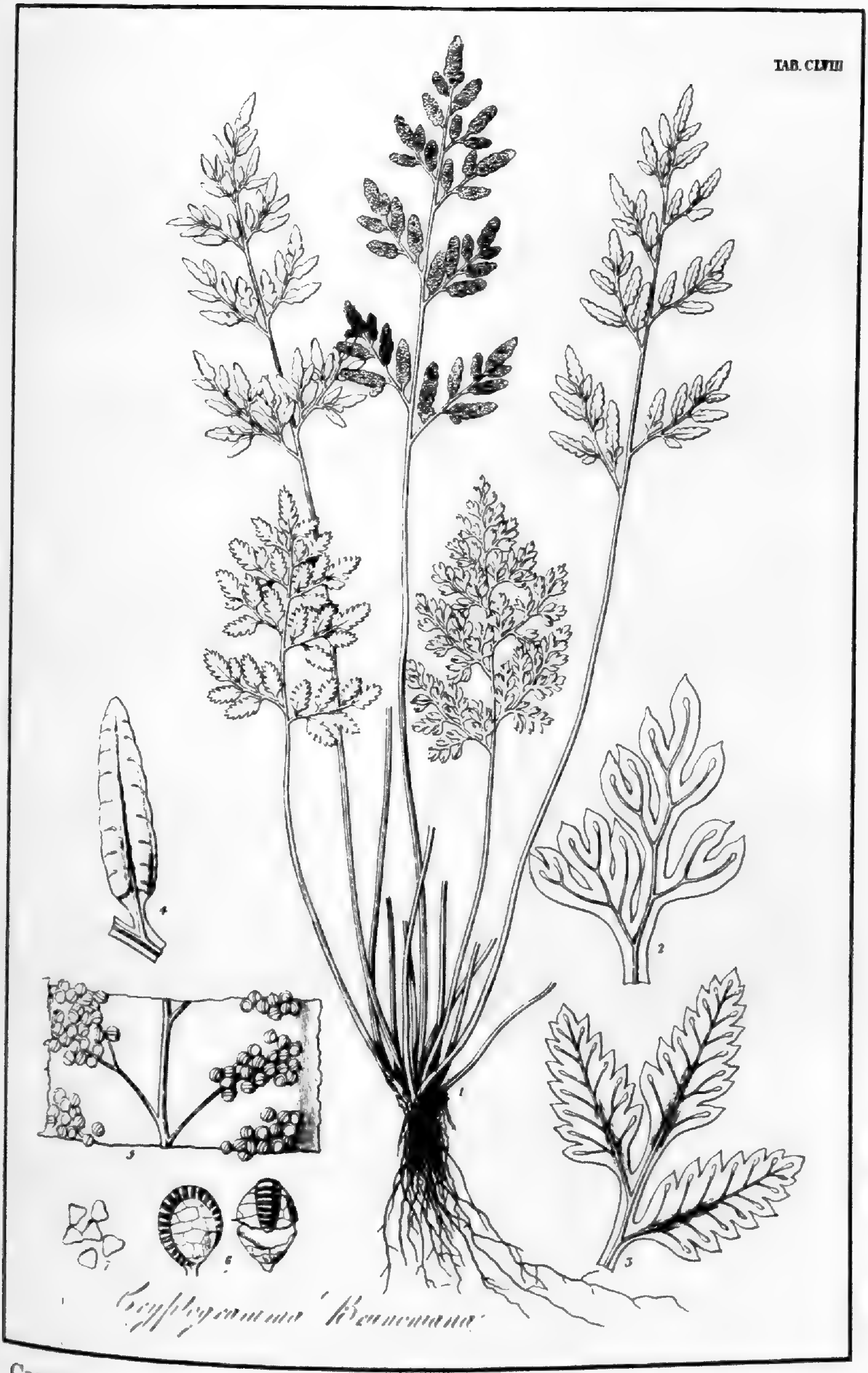
When an old plant is found in a very distant part of the world from its previously known locality, one is apt to look upon it as something new; and, as is the case with the Cedar of Lebanon and the Cedar of Himalaya, it is very difficult to remove the impression once made upon the mind, although no tangible character to distinguish them can be detected.

I shall now consider the different variations or forms of our plant, as much as possible under their respective countries, for I allow that the mass of specimens from Europe, Asia, and America, exhibit some slight differences, often not easily defined.[1]

Under his *Cryptogramma crispa,* forma *europaea* he continued

Notwithstanding that our learned friend, Mr. Brown, framed his character of *Cryptogramme* with a view to include our *C. crispa,* "quae dubia quidem species, ob soros abbreviatos potius subrotundos quam lineares," we are disposed to consider it by no means generically distinct, and not even specifically so, either from that gentleman's *C. acrostichoides,* or from the *C. Brunoniana* of Dr. Wallich. It is true that the chief distinction between the plant now under consideration and the two latter is, that *C. crispa* has often the fertile pinnules when mature narrower, with smaller or shorter sori and fewer sporangia, but that is very variable in different specimens, and these sori do not extend and become so completely confluent over the back of the pinnules as generally to force back the involucres, and thus to present a broader surface of pinnule, as is more or less common to the other two kinds; but this is a character not unlikely to depend on soil and climate, and which, in other Ferns, would not be considered of specific, much less of generic value. Another peculiarity in this state of *C. crispa* is, that its habit is more slender than

[1] Hook. Sp. Fil. ii. (pt. v.) 127, 128 (1858).



CRYPTOGRAMMA CRISPA, var. BRUNONIANA (*C. Brunoniana*, after Hooker & Greville).

Photo. E. C. Ogden.

PTERIDIUM AQUILINUM, var. LANUGINOSUM, forma DECIPIENS, × 3/5, from Quebec.

the continental forms, though even this is by no means universal; some of our specimens are very stout and firm.

Under forma *indica* (*C. Brunoniana*) he made the further note

I place this variety next to the European form, because, in the aggregate of specimens before me, the sterile fronds are exactly as in our European plant, that is, of two kinds, the one kind with the obovate segments deeply divided, serrated, single-nerved, the other with the pinnules elliptical, deeply serrated and pinnatedly veined, whereas the fertile pinnules more resemble those of the following (American) form, although they are not quite so large; but, while the majority of the Indian specimens are as here described, there are others that are more slender and flaccid, with fronds and narrower fertile pinnules, in short, in all particulars resembling our own native specimens.

And in discussing the American plant, his *C. crispa*, forma *americana* (*C. acrostichoides*), Hooker, citing the material of Richardson, Menzies and Douglas, said "The specimens from these stations may be considered the types of the *C. acrostichoides*, Br., and were the first recognized specimens referred to *Cryptogramme;* and they all have the broad, flattened, mature, fertile pinnules, the generally elliptical, rigid, sterile ones." Continuing, he cited the collections from southern Alaska (of Ruprecht, Barclay, Chamisso and Mertens) and made the significant note: "all these, and specimens just received (March, 1857)[1] from J [I]. A. Lapham, Esq., gathered on Isle Royale, Lake Superior, by W. D. Whitney, Esq.,—the only locality known within the United States,—possess quite the European form."

Somewhat earlier, in 1845, Ruprecht,[2] reducing *Cryptogramma* to *Allosorus*, recognized four species in the series now under discussion: *A. crispus* (L.) Bernh. of Europe; *A. foveolatus* Rupr., a renaming, in part, of *Cryptogramma acrostichoides* R. Br., the species said to have the fruiting fronds "valde similis A. crispo," but the sterile coriaceous and opaque, less dissected and with the margins of the upper surfaces strongly foveolate; *A. sitchensis* Rupr. from Sitka, with fronds more divided than in *A. foveolatus* and the foveae not apparent; and *A. Brunonianus* (Wall.) Rupr., the Himalayan plant which he separated from the two American merely by the mucronate pinnules of the sterile fronds ("differt ab A. foveolato et A. sitchensi pinnulis sterilibus mucronatis"). In this connection it should be noted that the conspicuous foveae emphasized by Ruprecht for the commoner American series were specially shown in Greville's plate of the type of *Crypto-*

[1] This item, "March, 1857," is of special significance in view of the date printed on the title-page, "1851."

[2] Rupr. Distrib. Crypt. Vasc. Imp. Ross. in Beitr. Pflanzenk. Russ. Reich. iii. 46, 47 (1845).

gramma Brunoniana. Ledebour[1] accepted Ruprecht's treatment but separated the American plants from the European as a section on the character alleged by Brown, the reputed difference in position of the sori, a "distinction without a difference," as pointed out by Hooker and several later students.

In 1867, without further comment, Hooker & Baker treated[2] *Cryptogramma* as a monotypic species, *C. crispa* R. Br. with two varieties: "β, *C. Brunoniana,* Wall." and "γ, *C. acrostichoides,* R. Br." And other European and Asiatic students of the ferns have expressed similar views. Thus, in 1867, Milde, retaining these plants in *Allosorus,* treated them as one species: *A. crispus* (L.) Bernh., with var. *acrostichoides* (R. Br.) Milde[3] and var. *Brunonianus* (Wall.) Milde. Var. *acrostichoides* was separated along the already emphasized lines, with the addition of the darker median band of the scales ("A forma europaea haec forma differt lamina sterili subcoriacea et segmentis ultimatis ovalibus crenatis, paleis medio coloratis"). However, an Alaskan specimen showed uniformly colored scales and one from the arid subalpine region of Spain had the foliage of the American plant, while even in Silesia plants transitional between the European and American were found ("Formae quae transitum ab europaea ad americanam significant, etiam in Silesia inveni [with citation of illustrations]. Sed multo copiosiores sunt formae ad Brunonianam spectantes, . . . Specimina Kadjakiana [from Kadiak Island, Alaska] paleis fere semper concoloribus, rarissime striolatis gaudebant. In Hispania . . . cl. *Lange* in regione subalpina specimina pusilla Allosori crispa legit, quorum segmenta ultima omnino formam hujus varietatis 'acrostichoides' habent"). Finally, Milde pointed out that the most significant difference is the presence of the conspicuous foveolae on the upper surfaces of the sterile pinnules in vars. *acrostichoides* and *Brunoniana* ("Quam levis momenti foveolae illae in pagina superiore varietatis *acrostichoidis* sint, ex hoc intelligendum est, quod eae quoque in varietate *Brunoniana* saepissime observandae sunt").

In 1880 in his *Review of the Ferns of Northern India,* C. B. Clarke was definite. Reducing *C. acrostichoides* and *C. Brunoniana* to *C. crispa* he said: "I can see no difference between the Himalayan and European plants, nor can I distinguish any Himalayan variety. Milde says the Himalayan form has the barren fronds with the ultimate segments

[1] Ledeb. Fl. Ross. iv. 525 (1853).
[2] Hook. & Bak. Synop. Fil. 144 (1867).
[3] Milde. Fil. Eur. et Atl. 24–26 (1867).

more acutely serrate; but I suspect Milde's stock of Himalayan material on which he ventured this distinction was small. I have collected the plant more than twenty times between Dhurmsala and the Karakorum. None resemble the American var. *acrostichoides*."[1]

In 1881, James Britten made an inconclusive but rather strong argument[2] for uniting all three as one species; in 1884, Boissier definitely treated[3] them all as one. In 1897 Christ[4] made short shrift of the question, treating *Cryptogramma crispa* as a species without varieties, occurring in Europe, Asia and North America; but in 1910[5] he wrote of the Asiatic and the North American plants as "Subspezies: *C. Brunoniana* . . . und in einer dritten: *C. acrostichoides*." In 1907, Hegi, likewise, united[6] them all as one species with Himalayan and American varieties. The latest European estimate of the three comes from Christensen in 1927. Writing of the Kamtchatkan plant, he calls it the American *C. acrostichoides*, but with the pertinent note:

> The beautiful specimens agree closely with the species quoted above, which was previously not known from Asia. The differences between it and the European *C. crispa* are so small that I am inclined, like Milde, to consider it a variety of *C. crispa*. Specimens collected, for instance, at Lofoten (Svolvaer), without doubt belonging to *C. crispa*, can scarcely be distinguished from *C. acrostichoides*. The best characters of this species show the basal scales, which are dark-brown in the centre (in *C. crispa* concolorous) and the small pits (faveolae — conf. the syn. *Allosurus faveolatus* Rupr.) on the upper side of the lamina above the tips of the veins; they are probably to be found only in dried specimens.[7]

In American treatments I find little or no reflection (except by George Lawson, whose viewpoint was essentially European) of the judgments of Hooker, Milde, Clarke and Christensen, that *Cryptogramma acrostichoides* is a geographic variety of *C. crispa*. With the works of Hooker and of Milde before him D. C. Eaton wrote, in 1880, of the American *C. acrostichoides* and the European *C. crispa:*

> The two plants are in fact so nearly allied that Hooker and Milde have considered the American only a variety of the European, and Hooker said that some of the Scottish specimens in his collection were almost identical with those from North America, and that he had some from the United States and from British Columbia quite agreeing with the common European form. While it is indisputable that there may be specimens from one continent much resembling the type usually seen in the other,

[1] C. B. Clarke, Trans. Linn. Soc. ser. 2, Bot. i. 459, 460 (1880).
[2] Britten, Europ. Ferns, 57–63 (1881).
[3] Boissier, Fl. Orient. v. 726 (1884).
[4] Christ, Farnkr. der Erde, 157 (1897).
[5] Christ, Geogr. der Farne, 123 (1910).
[6] Hegi Ill. Fl. Mitteleur, i. 36 (1907).
[7] Christensen in Hultén, Fl. Kamtch. and Adj. Isl. i. 43 (1927), where Christensen unjustifiably altered the spelling of *Allosorus foveolatus* to *A. faveolatus*.

yet the normal type of *C. acrostichoides* is so different from that of *C. crispa*, that, for the present purpose certainly, it is better to keep them apart.[1]

Eaton's treatment of the admittedly confluent plants of the two continents as two species, in spite of the inconstancy of the characters, has, apparently, been quite satisfactory to all American botanists. I can find no American treatment (except Lawson's in 1889) of it as a variety of *Cryptogramma crispa*. This is perhaps due to lack of sufficient Old World material for proper comparisons in many American herbaria or merely to the fact that attention has not been focussed on the question. We freely admit other circumboreal types, even though the American plants may often show well defined varietal differences: *Botrychium Lunaria, Cystopteris fragilis, Thelypteris Phegopteris* and *T. fragrans, Polystichum Lonchitis* and *P. Braunii, Athyrium Filix-femina* and *alpestre, Asplenium viride* and *septentrionale, Phyllitis Scolopendrium, Lycopodium annotinum, Selaginella selaginoides* and many others. Why, in view of the evidence, discriminate against *Cryptogramma crispa?*

The preceding summary of the conclusions of Hooker, Milde, Clarke, Christensen and others regarding the breaking down of specific lines between *Cryptogramma crispa*, at one end of the series, and *C. acrostichoides* at the other, was prepared after a personal study of the material had convinced me of the specific identity. In my own study of the material I had detected and correlated the characters which, to my great satisfaction, I find that others before me and with a tremendous advantage of experience and fuller material have already pointed out. The disrupted range (MAP 12) of the aggregate species, *C. crispa*, is such as to indicate that its geographic segregation was an early one. The three geographic varieties are indicated in the following synopsis.

Sterile fronds submembranaceous to subcoriaceous, when dry translucent to transmitted light, clearly displaying the nerves; nerve-tips not conspicuously foveolate; pinnules chiefly cuneate at base and deeply cleft: fertile fronds quadripinnate to bipinnate, with 35–200+ pinnules 0.2–1 cm. long: basal scales mostly concolorous, pale to full brown . . . . *C. crispa*, var. *typica*.

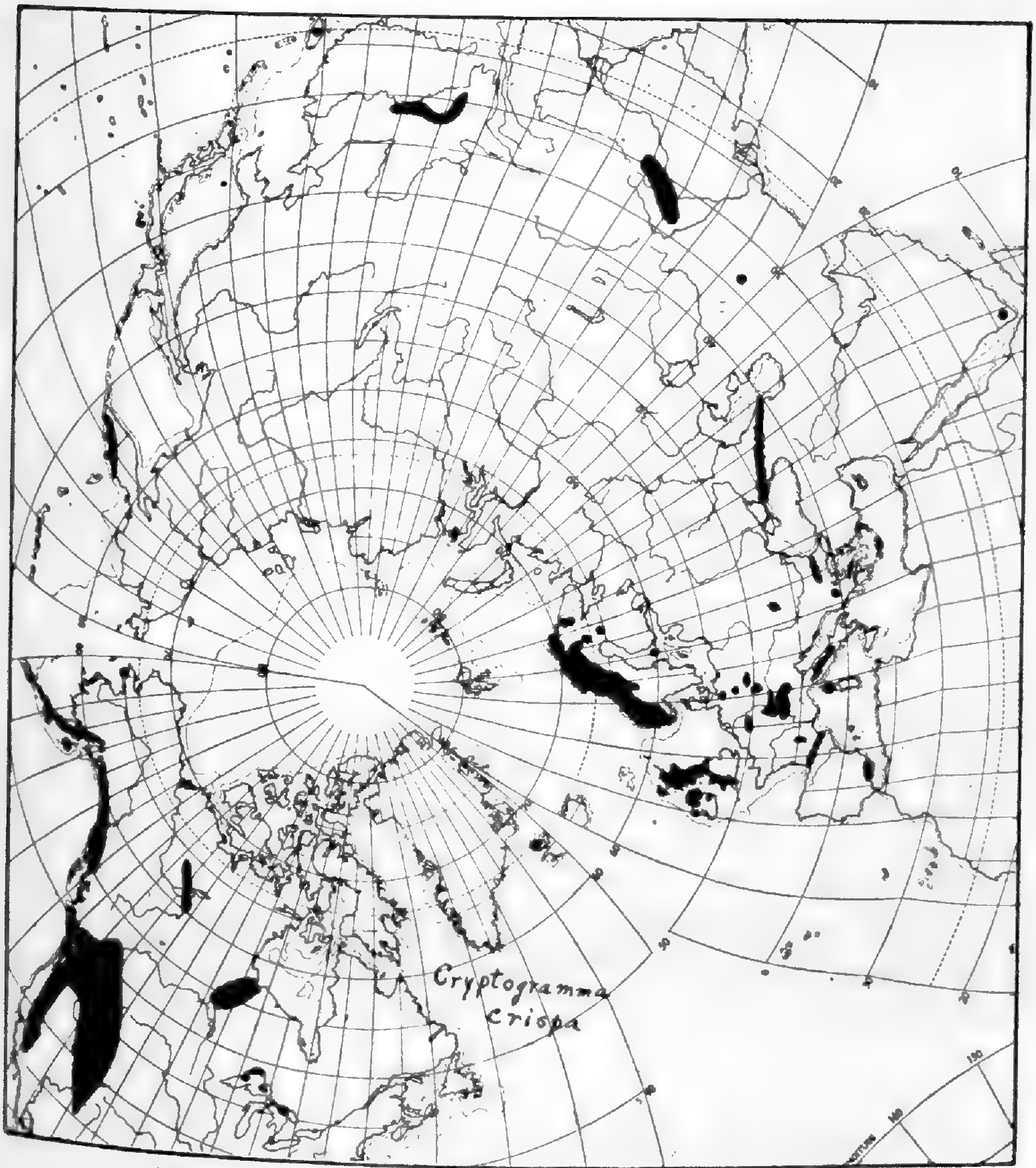
Sterile fronds chartaceous to coriaceous, opaque; nerve-tips (at least in dried specimens) conspicuously foveolate: fertile fronds bipinnate or tripinnate, with 25–115 pinnules 0.2–2 cm. long: basal scales mostly with median castaneous center, or concolorous.

Some or all of the sterile fronds with cuneate-obovate or subflabelliform deeply cleft pinnules: fertile pinnules 25–85, 0.2–1.1 cm. long; basal scales mostly pale and concolorous. Var. *Brunoniana*

[1] D. C. Eaton, Ferns of N. Am. ii. 102 (1880).

All the sterile fronds with oblong or narrowly elliptic crenate to incised pinnules: fertile pinnules 25–115, mostly 0.4–2 cm. long: basal scales mostly with casteneous centers. . . . . Var. *acrostichoides.*

C. crispa (L.) R. Br., var. **typica**. *Osmunda crispa* L. Sp. Pl. ii. 1067 (1753). *Pteris crispa* (L.) All. Fl. Pedem. ii. 284 (1785). *Acrostichum crispum* (L.) Vill. Hist. Pl. Dauph. iii. 838 (1789). *Polypodium crispum* (L.) Roth, Usteri Neu. Ann. ii. 10 Stück. 56 (1794).



Map 12. World-Range of Cryptogramma crispa.

Onoclea crispa (L.) Hoffm. Deutschl. Fl. ii. 11 (1795). *Allosorus crispus* (L.) Bernh. in Schrad. Neu. Journ. 1^2. 36 (1806). *Blechnum crispum* (L.) Hartm. Handb. Skand. Fl. 372 (1820). *Stegania onocleoides* S. F. Gray, Nat. Arr. Brit. Pl. ii. 16 (1821). *Phorolobus crispus* (L.) Desv. Prodr. 291 (1827). *Struthiopteris crispa* (L.) Wallr. Fl. Cr. Germ. i. 27 (1831). *C. crispa* (L.) R. Br. in Richardson, Frankl. Journ. App. ed. 1: 767, rep. 39 (1823) by implication but without transfer; Hook. & Bauer, Gen. Fil. t. cxv B (1842), where ascribed to Brown.—Europe and adjacent Asia.

Var. **Brunoniana** (Wallich), comb. nov. *C. Brunoniana* Wallich in Hook. & Grev. Icon. Fil. ii. t. clviii (1831); Beddome, Ferns Brit. Ind. t. clxiv (1868). *Gymnogramma Brunoniana* (Wall.) Presl, Tent. 219 (1836). *Allosorus Brunonianus* (Wall.) J. Smith, Journ. Bot. iv. 49 (1841). *Phorolobus Brunonianus* (Wall.) Fée, Gen. 131 (1850–52). *C. crispa,* forma *indica* Hook. Sp. Fil. ii. 129 (1858). *C. crispa,* β, *C. Brunoniana* (Wall.) Hook. & Baker, Syn. Fil. 144 (1867). *Allosorus crispus,* var. *Brunonianus* (Wall.) Milde, Fil. Eur. et Atl. 25 (1867). *C. crispa,* subsp. *C. Brunoniana* (Wall.) Christ, Geogr. der Farne, 123 (1910).—Alpine regions of the Himalayas; mountains of southern China; ? Japan. A few specimens, not wholly characteristic and with the castaneous scales and other characters transitional to the next, in southern Alaska, are referred as transitional to the next. They may include Ruprecht's proposed species. Plate 357.

Var. acrostichoides (R. Br.) C. B. Clarke, Trans. Linn. Soc. ser. 2, i. 460 (1880); Lawson, Fern Fl. Can. 236 (1889). *C. acrostichoides* R. Br. in Richardson, Frankl. Journ. App. ed. 1: 754, repr. 26, 767, repr. 39 (1823); Hook. & Grev. Ic. Fil. t. xxix. (1831); D. C. Eaton, Ferns N. Am. ii. 99, t. lix. figs. 1–5 (1880); Christensen in Hultén, Fl. Kamtch. and Adj. Isl. i. 43 (1927). *Allosorus foveolatus* Rupr. Distr. Crypt. Vasc. Imp. Ross. in Beitr. Pflanzenk. Russ. Reich. iii. 46 (1845). *A. sitchensis* Rupr. l. c. 47 (1845). *C. crispa,* forma *americana* Hook. Sp. Fil. ii. 130 (1858). *C. crispa,* γ, *C. acrostichoides* (R. Br.) Hook. & Baker, Syn. Fil. 144 (1867). *A. crispus,* var. *acrostichoides* (R. Br.) Milde, Fil. Eur. et Atl. 24 (1867). *C. acrostichoides,* forma *foveolata* (Rupr.) Gilbert, List N. Am. Pterid. 16 and *C. acrostichoides foveolata* (Rupr.) Gilbert, l. c. 36 (1901), the latter repeatedly spoken of as "a variety," and "this variety," although on the earlier page it was called a forma! *C. crispa,* subsp. *C. acrostichoides* (R. Br.) Christ, Geogr. der Farne, 123 (1910).—Kewatin to Alaska and Kamtchatka, south, locally, to islands of Lake Huron, Ontario, of Lake Superior, Ontario and Michigan, and along the mountains to New Mexico and southern California. Plate 356.

In its very thick and opaque fronds, as compared with the submembranaceous and translucent fronds of the European *Cryptogramma crispa,* our var. *acrostichoides* shows the result of long-continued growth in the drier region of North America as contrasted with the generally more humid western Eurasia. Var. *acrostichoides* is stated to grow in Labrador (Britton & Brown); and Macoun (Cat. Can. Pl.) seems to quote Hooker as assigning it to "Rocks along the Arctic coast from Mackenzie River to Baffin Bay." I have not seen it from Labrador nor from within the Arctic Circle, nor can I trace Macoun's statement ascribed to Hooker. Ostenfeld did not know of it in Flora Arctica; neither did Simmons in his extensive studies of the Arctic

American flora. European authors have designated some other and later Old World varieties, which I have not been able to study; also one from Chile, which is open to serious doubt.

Pteridium aquilinum (L.) Kuhn. var. **lanuginosum** (Bong.), comb. nov. *Pteris aquilina*, var. *lanuginosa* Bong. Mém. Acad. St. Pétersb. sér. 4, ii. 176 (1832). *Pteridium aquilinum*, var. *pubescens* Underw. Our Native Ferns, ed. 6: 91 (1900). *Pteris aquilina pubescens* (Underw.) Clute, Fern. Bull. xv. 124 (1907). *Filix-foemina aquilina* (L.) Farwell, var. *lanuginosa* (Bong.) Farwell, Am. Midl. Nat. xii. 290 (1931).

When Underwood published *Pteridium aquilinum*, var. *pubescens* in 1900 he was working under one of the so-called American rules which rejected a name if it repeated one ever used under the genus in any category. Consequently, since there had been a *Pteris lanuginosa* Bory (1810), Underwood rejected Bongard's varietal name (1832). Under the International Rules the latter must be retained.

Pteridium aquilinum, var. *lanuginosum* is the common bracken of western North America, from Alaska to California, Arizona, New Mexico and the high mountains of western Texas, south along the mountains to Guatemala, with an eastward extension into the Black Hills of South Dakota. East of the Black Hills it is highly localized: on the Gaspé Peninsula, where the cordilleran relationship is well known, the Gaspé plant being the basis of Lawson's *Pteris aquilina*, γ. *decipiens;* on the serpentine slopes and high crests near Black Lake, Megantic Co., Quebec (*Fernald & Jackson*, nos. 11,690 and 11,691), a region famous, also, for its remarkably localized relic-colonies of cordilleran plants (*Adiantum pedatum*, var. *aleuticum* Rupr., *Pellaea densa* (Brack.) Hook., *Festuca scabrella* Torr., etc.); and at Tobermory, at the tip of the Bruce Peninsula, another area famous for its isolated colonies of apparently relic species. Its other area eastward is in northern Michigan. The following Michigan specimens are in the Gray Herbarium: shore of Lake Superior, *C. T. Jackson;* Mackinac Island, *C. F. Wheeler*, no. 85; openings and thickets back of West Bluff, Keweenaw Co., *Fernald & Pease*, no. 3033. In the Gray Herbarium there are specimens reputed to come from New Jersey and Pennsylvania; their data, entered second-hand, is open to grave doubt. See p. 205

The plant described by Lawson from Gaspé as *Pteris aquilina*, γ *decipiens* is a remarkable form. Conventially, *Pteridium aquilinum* is characterized by its conspicuously deltoid frond. Lawson's account of his remarkable plant follows.

Pteris aquilina, Linn. . . . γ. *decipiens*.—Frond bipinnate, thin and membranous, lanuginose, pinnules pinnatifidly toothed, or, in small forms, entire, barren; L'Anse à Cabièlle, Gaspé, John Bell, B. A. This is a very remarkable fern, resembling a Lastrea, and in the absence of fructification, it is doubtfully referred to *Pteris aquilina*, yet the venation seems to indicate that it belongs to that species. . . . Being at a loss what to make of this fern, I sent it to Mr. D. C. Eaton, M. A., who is justly looked up to by American botanists as our best authority on American ferns, and he likewise failed to recognize it. I hope some visitor to Gaspé will endeavuor to obtain it in a fertile state, and thus relieve the doubt.*

* Since the above was written, I have had an opportunity of studying the forms and development of *Pteris aquilina*, and am quite satisfied that the doubtful plant is a state of that species, not old enough to be fertile.

Although Lawson's hope that some one would secure fertile plants from Gaspé of his *Pteris aquilina*, γ. *decipiens* was not fulfilled before his death, material (PLATE 358) which, unquestionably, belongs with it was collected by my former student, Dr. H. B. Jackson, and myself near the crest of Caribou Hill in Megantic Co., Quebec. There, as already noted, it is associated with a remarkable assemblage of relic-colonies of cordilleran plants. It is, therefore, significant that the Caribou Hill plant should have the ciliate indusium and the pubescence which characterize the cordilleran *Pteridium aquilinum*, var. *lanuginosum*. Another number from Caribou Hill is less unlike typical var. *lanuginosum*. It is, therefore, better to treat the plant with bipinnate fronds "resembling a Lastrea" as a form rather than as a true geographic variety. Mr. Ogden has photographed two of the fronds, × 3/5, of the fertile material from Caribou Hill (PLATE 358). Their superficial resemblance to *Thelypteris* (*Lastrea*) *marginalis* (L.) Neiuwl. is apparent. This form should be called

PTERIDIUM AQUILINUM, var. LANUGINOSUM, forma **decipiens** (Lawson), comb. nov. *Pteris aquilina*, γ. *decipiens* Lawson. Edinb. New Phil. Journ. n. s. xix. 110 (1864).—reprinted as Syn. Canad. Ferns and Filic. Pl. 11 (1864). Known only locally in Quebec. PLATE 358.

LYCOPODIUM SELAGO L., var. PATENS (Beauv.) Desv. MICHIGAN: glades and openings in thicket bordering calcareous beach of Lake Michigan, east of Manistique, Schoolcraft Co., no. 3060.

The only Michigan station for *L. Selago* cited by Dodge, is Farwell's in Keweenaw Co. Robbins got typical *L. Selago* in 1863 at Dana Mine, ?Keweenaw Co. (Gray Herb.) and Cooper got it on Isle Royale.

SELAGINELLA SELAGINOIDES (L.) Link. Cited for Michigan by Dodge only from Isle Royale and from Keweenaw Co., Upper Peninsula; reported by Gates & Ehlers from Emmet Co. The following additional stations are represented in the Gray Herbarium from MICHIGAN: Marquette Island, Mackinac Co., August 27, 1913, *W. H.*

Photo. E. C. Ogden.

FESTUCA OVINA AND ALLIES IN EASTERN AMERICA: FIGS. 1 and 2, F. OVINA; 3 and 4, F. OVINA, var. DURIUSCULA; 5 and 6, F. SAXIMONTANA; 7 and 8, F. BRACHYPHYLLA; 9, F. SUPINA; 10 and 11, F. VIVIPARA; 12 and 13, F. CAPILLATA; panicles, × 1; spikelets, × 5.

Photo. E. C. Ogden.

CAREX GARBERI: FIG. 1, small plant, × 1; FIG. 2, orifice of sheath, × 5; FIG. 3, spike, × 5; FIG. 4, staminate scales, × 5; FIG. 5, denuded rachis, × 10; FIG. 6, perigynium, × 10.

C. GARBERI, var. BIFARIA: FIG. 11, portion of plant, × 1; FIG. 12, perigynium, × 10.

C. HASSEI: FIG. 7, spike, × 5; FIG. 8, staminate scales, × 5; FIG. 9, orifice of sheath, × 5.

C. AUREA: FIG. 10, portion of spike, × 5.

Manning; Mackinac, August, 1885, *T. E. Boyce;* shore of Thunder Bay Island, Alpena Co., July 18, 1885, *C. F. Wheeler;* glades and openings in thicket bordering calcareous beach of Lake Michigan, east of Manistique, Schoolcraft Co., no. 3061.

POTAMOGETON OAKESIANUS Robbins. MICHIGAN: with *Eleocharis Robbinsii* Oakes, *Utricularia geminiscapa* Benj., *Eriocaulon septangulare* With. and *Drosera intermedia* Hayne in pools in a bog near Rock River, Alger Co., no. 3066.

Reported by Oosting (Pap. Mich. Acad. xv. 159) from a number of counties in the Lower Peninsula and Gogebic in the Upper Peninsula.

PANICUM DEPAUPERATUM Muhl., var. PSILOPHYLLUM Fern. When I described this glabrous-sheathed variety, RHODORA, xxiii. 193 (1921), I had not seen it from Michigan. The following collections establish its presence on the Upper Peninsula: sandy barrens west of Norway, Dickinson Co., no. 3068; sandy open pine barrens north of Gladstone, Delta Co., no. 3072.

PANICUM LINEARIFOLIUM Scribn. The broad range, "Maine to Kansas, south to Georgia and Texas" given by Hitchcock & Chase, excludes the region north of Lake Huron. Our collection from dry gneiss hills, Awrey, Sudbury District, ONTARIO, no. 3069, is from north of the Lake.

P. LINEARIFOLIUM, var. WERNERI (Scribn.) Fern. (*P. Werneri* Scribn.) The range given by Hitchcock & Chase is extended slightly northward. ONTARIO: dry gneiss hills east of Wasapitei, no. 3070. MICHIGAN: dry, open pine woods, Bête Grise, Keweenaw Co., no. 3071.

P. LANUGINOSUM Ell., var. LINDHEIMERI (Nash.) Fern. (*P. Lindheimeri* Nash). The northernmost stations cited by Hitchcock & Chase for Ontario and Michigan give no indication that the plant extends into the northern half of the Lake Huron region. The following collections represent this area. ONTARIO: calcareous gravel by pools, Cloche Peninsula, Manitoulin District, no. 3077; sandy shore of Lake Huron, Algoma, Algoma Distr., no. 3076. MICHIGAN: sandy and stony beach of Lake Huron, south of Alpena, no. 3082.

P. COLUMBIANUM Scribn. (Including *P. tsugetorum* Nash). The broad range given by Hitchcock & Chase (for *P. tsugetorum*), "Maine to Illinois," etc., excludes northern Ontario and the Upper Peninsula of Michigan. The following collections show its occurrence there. ONTARIO: dry gneiss hills east of Wasapitei, Sudbury Distr., no. 3073, and dry sandy plains and barrens, Espanola, Sudbury District, nos. 3074, 3075. MICHIGAN: sandy, open pine barrens north of Gladstone, Delta Co., no. 3080.

ORYZOPSIS CANADENSIS (Poir.) Torr. (*Stipa canadensis* Poir.). ONTARIO: dry sandy plains and barrens, Espanola, Sudbury Distr., no. 3090. MICHIGAN: dry spruce and pine barren near Humboldt, Marquette Co., no. 3089.

Previously known from east of Georgian Bay and from the north shore of Lake Superior, Ontario.

Stipa spartea Trin. Ontario: sandy shore of Lake Huron, Algoma, Algoma Distr., no. 3092.

Previously known on the southern and eastern shores of Lake Huron as far as the tip of Bruce Peninsula: Tobemory, *Krotkov*, no. 7135.

Melica Smithii (Porter) Vasey. The measurements given by Hitchcock in Gray, Man. ed. 7, should be extended, in view of our new collections from northern Michigan: culms up to 1.5 m. high; blades to 1.5 cm. broad; panicle to 4.3 dm. long; spikelets to 2.4 cm. long (and down to only 1 cm. long). See p. 218 and map 11.

Poa sylvestris Gray. Michigan: woods south of L'Anse, Baraga Co., no. 3111.

Near, if not its northern limit in the state.

The Allies of Festuca ovina in eastern America (Plate 359). —The members of the *ovina* series in eastern North America (separated from the *rubra* series by having the lower sheaths mostly whitish or drab, chartaceous, persistent, not soon disintegrating into fibers; new basal offshoots strongly ascending, from within the sheaths; anthers ¼–½ as long as the palea) are distinguished by the following characters.

a. Lemmas coriaceous to membranaceous, with awns at most 3 mm. long (or wanting); ovaries glabrous; panicles strict, rarely 1 dm. long. . . . *b.*
  b. Awns 1. 3–3 mm. long. . . . *c.*
    c. Panicle loosely open, with divergent short branches during anthesis, oblong to ellipsoid; lemmas coriaceous, strongly involute; anthers 2.5–3 mm. long.
      Culms 1.5–3 (–6) dm. high; leaves 0.4–0.6 mm. in diameter, 5–7-nerved; panicles 2–5 cm. long; spikelets 5–7 mm. long, 3–6-flowered; 2d glume 2.5–4 mm. long; lowest lemma 3–5 mm. long . . . . *F. ovina.*
      Culms up to 7 dm. high; leaves 0.7–1.2 mm. broad, 7–9-nerved; panicles 4–10 cm. long; spikelets 7–10 mm. long, 4–9-flowered; 2d glume 3.5–5 mm. long; lowest lemma 4.5–6 mm. long . . . . *F. ovina*, var. *duriuscula.*
    c. Panicle spiciform and close or loosely linear-cylindric to loosely lanceolate; anthers less than 2 mm. long.
      Panicle linear-cylindric or loosely lanceolate, 2–10 cm. long; lemmas greenish, coriaceous, strongly involute; anthers 1.2–1.7 mm. long . . . . *F. saximontana.*
      Panicle dense, closely spiciform at least above, cylindric to lance-ovoid, usually 1–3 cm. long; lemmas purplish or bronze, membranaceous, tardily, if at all, involute; anthers 0.5–1 mm. long . . . . *F. brachyphylla.*
  b. Awnless or with awns at most 0.6 mm. long.
    Florets modified into leafy proliferous shoots; 2d glume 3–5 mm. long; lemmas membranaceous, not strongly inrolled, 4–6 mm. long; stamens wanting . . . . *F. vivipara.*

Florets normal, perfect; 2d glume 2–2.7 mm. long; lemmas coriaceous, tightly inrolled, 3–3.5 mm. long; anthers 1.5–2 mm. long . . . . *F. capillata.*

a. Lemmas membranaceous, 5–6.5 mm. long, with awns 2.5–7 mm. long; ovary pubescent at summit; panicle lax, flexuous, mostly 1–2.5 dm. long. . . . . *F. occidentalis.*

F. OVINA L. Sp. Pl. i. 73 (1753).—Eurasian; introduced in North America, and naturalized in dry soils, from Quebec to western New York and New Jersey. FIGS. 1 and 2.

Forma HISPIDULA (Hack.) Holmb., Scand. Fl. hft. ii. 234 (1926) (*F. ovina*, var. *vulgaris*, subvar. *hispidula* Hack. Mon. Fest. Eur. 87 (1882)) has hispid lemmas.

Var. DURIUSCULA (L.) Koch, Syn. 812 (1857). *F. duriuscula* L. Sp. Pl. 74 (1753).—More frequent, Newfoundland to Minnesota and Pennsylvania. FIGS. 3 and 4.

F. SAXIMONTANA Rydb. Bull. Torr. Bot. Cl. xxxvi. 536 (1909). *F. ovina*, var. *pseudovina* Beal, Grasses, N. Am. ii. 595 (1896), not *F. pseudovina* Hack. (1880). *F. pseudovina* Rydb. Mem. N. Y. Bot. Gard. i. 56 (1900), not Hack. (1880).—Dry crests, hills and sands, western Newfoundland; eastern Quebec; Smugglers Notch, Vermont; shores of Lake Huron, Ontario to British Columbia, south to Michigan, Wisconsin, Minnesota, Nebraska, Colorado and Utah. FIGS 5 and 6.

F. BRACHYPHYLLA Schultes, Man. iii. 646 (1827). *F. brevifolia* R. Br. App. Parry's Voy. Suppl. 289 (1824), not Muhl. (1817). *F. ovina*, var. *brevifolia* (R. Br.) Hack. Bot. Centralb. viii. 406 (1881). *F. ovina brachyphylla* (Schultes) Piper, Contr. U. S. Nat. Herb. x. 27 (1906). *F. supina* Am. Auth., not Schur (1866). *F. ovina supina* Piper, l. c. (1906), in part, not (Schur) Hack. (1881).—Greenland and arctic America, south to bleaker areas of Labrador, northern and western coast and mountains of Newfoundland, Anticosti Island and Shickshock Mts., Quebec, Keweenaw Co., Michigan, and alpine regions to Colorado, Utah, Nevada and California. FIGS. 7 and 8.

Although the arctic-alpine American plant is often passing as the central European *Festuca supina* Schur, it is very different, as worked out in the Gray Herbarium by my former student, now Dr. Ernst Abbe, when identifying his Labrador material. *F. supina* (FIG. 9) has anthers 2–3 mm. long, while the arctic-alpine American plant has them minute (0.5–0.8, rarely –1 mm. long). FIG. 9 is from *Petrak*, Fl. Bohemiae et Moraviae Exsicc. Lfg. VIII. no. 717, from near the type locality of *F. supina*.

F. VIVIPARA (L.) Sm. Fl. Brit. i. 114 (1800); Fernald, RHODORA, xxviii. 151 (1926). *F. ovina*, β, *vivipara* L. Sp. Pl. ed. 2, i. 108 (1762).—Arctic regions, south to mts. of Europe; in America from Greenland and Labrador to northern and western Newfoundland, Anticosti Island and Shickshock Mts., Quebec. FIGS. 10 and 11.

F. CAPILLATA Lam. Fl. Fr. iii. 597 (1778). *F. tenuifolia* Sibth. Fl.

Oxon. 44 (1794). *F. ovina*, var. *capillata* (Lam.) Hack. Bot. Centralb. viii. 405 (1881).—European; indigenous on dry open soil in southern Newfoundland, apparently also in Nova Scotia; introduced and naturalized westward to Michigan and south to Pennsylvania. Figs. 12 and 13.

F. occidentalis Hook. Fl. Bor. Am. ii. 249 (1840); Piper, Contrib. U. S. Nat. Herb. x. 24, pl. viii. (1906). *F. ovina*, var. *polyphylla* Beal, Grasses N. Am. ii. 597 (1896).—British Columbia to California, eastward to western Montana and northwestern Wyoming; woodlands of northern Michigan and adjacent Ontario eastward to Manatoulin Island and Bruce Peninsula.

Piper's diagnostic plate is so good that it is not necessary to illustrate this species.

Agropyron trachycaulum (Link) Malte. Ontario: limestone pavement and gravel, Great Cloche Island, no. 3141.

When I published on this group (Rhodora, xxxv. 170) the typical form of the species was unknown to me from between Lake Superior and the lower St. Lawrence. Its occurrence on the recently exposed beach of Great Cloche Island suggests that it may be more widely spread about Lake Huron.

Scirpus Clintonii Gray. Michigan: dry sandy plains near Driggs, Schoolcraft Co., no. 3153.

The only stations recorded by Beal are on the Lower Peninsula.

Rynchospora capillacea Torr., forma **leviseta** (E. J. Hill), comb. nov. *R. capillacea*, var. *leviseta* E. J. Hill ex Gray, Am. Nat. x. 370 (1876). *Phaeocephalum capillaceum* (Torr.) Farwell, var. *levisetum* (E. J. Hill) Farwell, Report Mich. Acad. Sci. xxi. 361 (1920).

The form with smooth instead of retrorsely barbellate bristles is interesting and worthy a designation, but it has no distinctive range, colonies of it occurring here and there through the broad range of the less localized typical *Rynchospora capillacea*. It is better considered a forma rather than a geographic variety. When it was first published, as noteworthy for its "*perfectly smooth*" bristles, it was clearly stated that "Except in this remarkable particular the plant appears to be undistinguishable from *R. capillacea*." Many subsequent collections strengthen this assertion.

Carex praegracilis W. Boott. (*C. marcida* Boott, 1839, not J. F. Gmel., 1791). Michigan: forming dense carpets in damp sand, Eagle Harbor, Keweenaw Co., no. 3158.

A species of western North America (also South America) primarily of the cordilleran and Great Plains regions, from Yukon to central Mexico, heretofore known as an indigenous plant eastward to Manitoba, Minnesota and Iowa (Mackenzie, N. Am. Fl.). The Eagle Harbor colony is certainly indigenous, in damp depressions in the typical barrens of *Pinus Banksiana.*

C. Hookerana Dewey. Ontario: roadside, Schreiber, Thunder Bay District, *Pease & Bean,* no. 23,599.

Another species of the plains and prairies now extended eastward, from Manitoba and North Dakota, to the Lake Superior region. As noted in N. Am. Fl. the specific name was published by Dewey as *Hookerana* (not *Hookeriana* to which it has usually been altered). Dewey's material from Carlton House (type in Gray Herb.) is distinctly called "*C. Hookerana* D."

C. exilis Dewey. Michigan: very abundant (dominant) on a muskeag near Walsh, Schoolcraft Co., no. 3165.

The previously reported Michigan stations are in Keweenaw Co.

Carex **Garberi**, n. sp. *C. aurea,* var. *àndrogyna* Olney in Bot. King Exp. 371 (1871), not *C. androgyna* Balb. Elencho, 97 (1801). Type: Presque Isle, Erie Co., Pennsylvania, June 9, 1869, *A. P. Garber,*[1] in herb. Olney (Brown Univ.); isotype in Gray Herb. Plate 360, figs. 1–6.

Carex Garberi is the plant treated in Gray, Man. ed. 7: 232 (1908) as *C. bicolor* All., the plant which, after its first collection on Lake Superior, long stood in North America as *C. bicolor.* Agassiz got it in 1848 on the north shore of Lake Superior and it was then identified by Asa Gray as *C. bicolor* and so recorded by Agassiz.[2] Its relationship is, however, with *C. aurea* Nutt. and *C. Hassei* Bailey, with which it has, very naturally, been confused. With *C. Hassei* (figs 7–9) it shares the whitish papillose and dry perigynia and close spike which separate them both from *C. aurea* (fig. 10), which has the spike loosely few-flowered and the mature perigynia fleshy, smooth, globose-pyriform and golden-orange (drying brownish). Mackenzie has been treating *C. Garberi* (*C. aurea,* var. *androgyna*) as identical with *C. Hassei* of the western United States; but, although they are both distinguished from *C. aurea* by their whitish and papillose mature perigynia and closely-flowered spikes, they differ in several important characters, indicated below.

C. Hassei: inner summit of sheath of foliaceous bracts truncate (fig. 9); spikes mostly remote, the terminal usually staminate throughout; scales of fertile spikes (fig. 7) firm, ovate, mostly acuminate or prolonged into long awns, 2–4 (–6) mm. long; lowest scales of terminal spike (fig. 8) firm, 3.5–5 mm. long, acuminate; principal staminate scales narrowed above to blunt tips, not white-margined.

[1] Abraham Pascal Garber, 1838–1881.

[2] Agassiz, Lake Superior, 166 (1850).

C. Garberi: inner summit of sheath V-shaped (fig. 2); spikes closely crowded and imbricated, the terminal androgynous or wholly pistillate; scales of fertile spikes (fig. 3) membranaceous, broadly oblong or ovate to obovate, mostly rounded at summit (rarely acute) or merely short-mucronate, 1.5–2.5 mm. long; lowest scales (fig. 4) of terminal spike membranaceous, obtuse or merely acute, 2–3.5 mm. long; principal staminate scales broadly rounded at summit, with pale scarious margin.

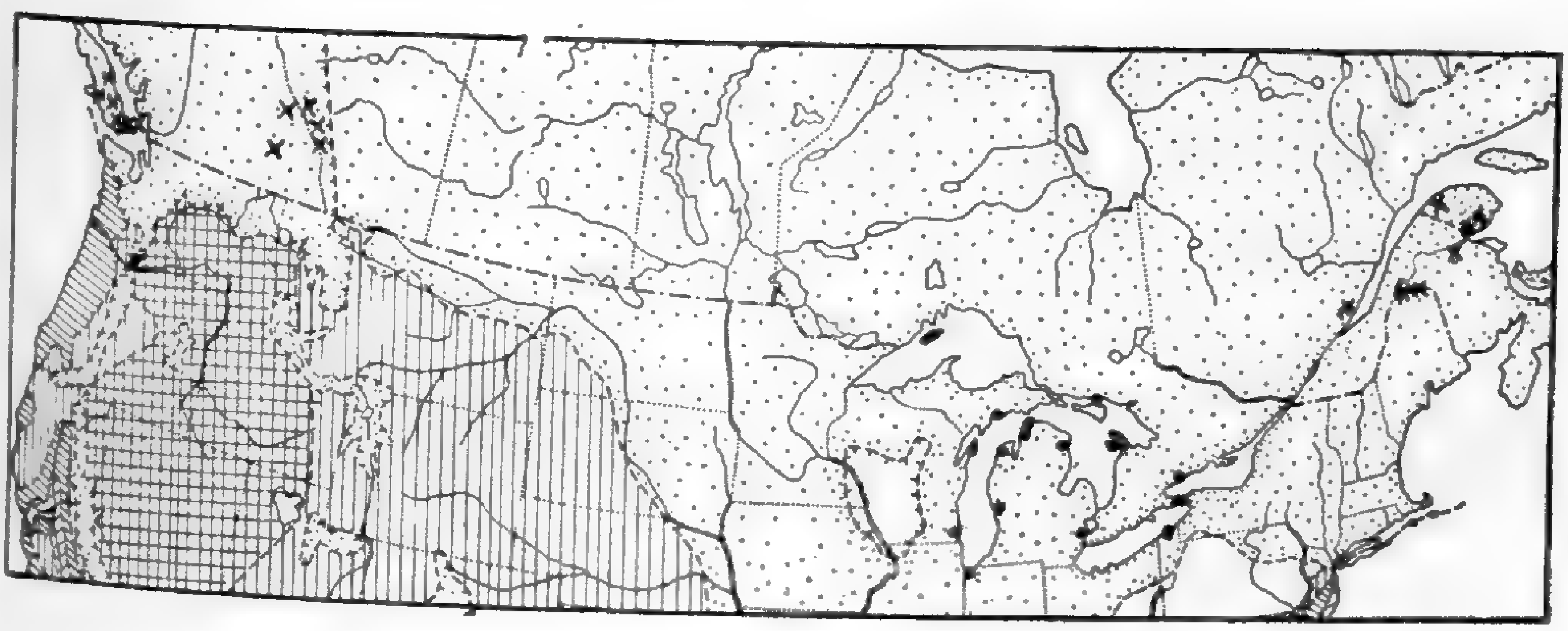
Carex Garberi (fig. 1), abundant on beaches and rocky shores of the Great Lakes from Niagara to the head of Lake Michigan and the north shore of Lake Superior, is stiff, with strict culms 1–3 dm. high, leaves 2.5–5.5 mm. broad; fastigiate and closely approximate spikes 1–3 cm. long; scales almost colorless to medium-brown. The following specimens are in the Gray Herbarium, indicating a general occurrence on shores of the Great Lakes (map 13, dots).

New York: Goat Island, Niagara, June 18, 1865, *Wm. Boott.* Pennsylvania: Presque Isle, Erie Co., June 9, 1869, *A. P. Garber* (type in Olney Herb.—type of *C. aurea*, var. *androgyna;* isotypes in Gray Herb.); damp sand dunes, Presque Isle, *Pease*, no. 12,988. Ontario: shore of Hay Bay, Tobermory, Bruce Co., *P. V. Krotkov*, no. 7144; crevices in limestone, shore of Round Island, Fishing Islands, *Stebbins et al.*, no. 60; limy sand of Sauble Beach, Bruce Co., *Fernald*, no. 3180; peaty depressions in limestone pavement, Great Cloche Island, *Fernald & Pease*, no. 3181; north shore of Lake Superior, 1848, *Agassiz.* Michigan: Isle Royale, *Cooper*, no. 215; calcareous gravel, bordering Bay du Noc, north of Garden, *Fernald & Pease*, no. 3184; calcareous sandy or stony beach of Lake Michigan, east of Manistique, *Fernald & Pease*, no. 8183; wet gravelly shore of Lake Michigan, Mackinaw City, *Gleason & Gleason*, no. 60; sandy banks of creeks, Big Stone Bay, Emmet Co., *Ehlers*, nos. 309, 505; shore of Thunder Bay, Alpena Co., July 15, 1895, *C. F. Wheeler;* Highland Park, Detroit, 1895, *Wheeler*; swale in jack pine plains near Lake Michigan, Glen Haven, Leelanau Co., *F. J. Hermann*, no. 2309; sand dunes near Muskegon, June 28, 1900, *C. F. Wheeler.* Wisconsin: Point of North Bay, Door Co., June 29, 1873, *Schuette;* damp sand, Sand Beach near Rowley's Bay, Door Co., *Pease*, no. 18,007; Racine, June 19, 1881, *J. J. Davis.* Indiana: wet sands, Pine, June 7, 1884, *E. J. Hill*, no. 35; sandy open woods, Pine, *Lansing*, no. 2721.

Typical, strict *Carex Garberi* (fig. 1) of the Great Lakes region has a smaller representative (figs. 11 and 12) in the Northeast and in the Northwest. This plant is weak and flexuous, with leaves narrow, spikes fewer-flowered, short (0.5–2 cm. long) and more spreading on arching peduncles and less approximate, castaneous scales, and perigynia (fig. 12) often with longer stipes and more papillose. It occurs along the rivers and shores from Gaspé Co., Quebec to northern New England and, still farther to the west of the Great Lakes, in the

Canadian Rocky Mountains. On account of this geographic segregation of its areas the plant may be called

C. Garberi, var. **bifaria**, var. nov. (tab. 360, figs. 11 et 12), a var. typico simillima a qua differt habitu laxiori, culmis gracillimis flexuosis ad 4.5 dm. alto; foliis 1–2.5 mm. latis; spicis vix confertis plus minusve subdistantibus, 0.5–2 cm. longis; squamis castaneis (rare pallidis); perigyniis plerumque longe stipitatis valde papillosis.—Calcareous gravelly, sandy or ledgy shores, Gaspé Co. to Quebec Co., Quebec and the St. John River, New Brunswick and Maine; southern Alberta and southern British Columbia. Type: wet limestone ledges by River Ste. Anne des Monts, Quebec, August 3–17, 1905, *Collins & Fernald* in Gray Herb. (map 13, *x*'s).



Map 13. Range of Carex Garberi (dots) and of var. bifaria (*x*'s).

Most of the specimens have been distributed either as *Carex bicolor* All. or as *C. Hassei* Bailey; a few of them as *C. aurea* Nutt. In mature fruit there is no difficulty in distinguishing *C. Garberi* and its var. *bifaria* from *C. aurea*. When immature they are difficult to tell with certainty. The foliaceous bracts of *C. aurea* are usually more prolonged, the spikes (fig. 10) less crowded or even remote and more peduncled, the flowers or fruits comparatively few and less densely overlapping, the scales longer and more often acuminate; and when the perigynia have dropped the denuded axis of the spike in *C. aurea* has the scars or joints more remote than in *C. Garberi* (fig. 5).

C. scirpoidea Michx., var. convoluta Kükenthal in Engler, Pflanzenr. iv[20]. 81 (1909). Originally cited only from Thunder Bay Island, Michigan. The following are in the Gray Herbarium, showing a broad range on calcareous shores of Lake Huron. Ontario: Little Eagle Harbor, *J. Macoun*, no. 33,729; Bruce Co., 1871, *J. Macoun;* limestone pavement and gravel, Great Cloche Island, no. 3188. Michigan: Drummond's Island, *Winchell;* Point Detour, June 30, 1860, *Wm. Boott;* Thunder Bay Island, July 18, 1895, *C. F. Wheeler.*

This plant of shores of Lake Huron is strongly pronounced in its convolute to almost filiform leaves.

C. concinna R. Br. Ontario: dry arbor vitae woods on limestone pavement, Great Cloche Island, Manitoulin District, no. 3201; Cove Island (off Tobermory), Bruce Co., *Krotkoff*, no. 7183 (Univ. of Toronto). Wisconsin: sandy woods on beach, Ephraim, Door Co., *Pease*, no. 18,016.

The only Ontario station given by Macoun or represented in the National Herbarium at Ottawa is on Lake Nipigon. The Wisconsin station is slightly farther south than the Michigan station (Big Stone Bay) cited by Mrs. Ehlers (Papers Mich. Acad. Sci. iv^1. 209).

C. Richardsoni R. Br. Ontario: turfy limestone pavement, Cloche Peninsula, no. 3202. Michigan: wind-swept crests, crevices and talus of sandstone-conglomerate, West Bluff, Keweenaw Co., no. 2303.

Already recorded from the Bruce Peninsula and from stations farther east in Ontario; not previously recorded, I think, from the Upper Peninsula of Michigan.

Juncus Vaseyi Engelm. Michigan: dry sandy plain near Driggs, Schoolcraft Co., no. 3223.

Apparently the first record for the Upper Peninsula.

Zigadenus glaucus and Z. elegans (Plate 361).—In the current manuals the plant of the St. Lawrence basin, from Minnesota eastward to the limestones, shales and slates bordering the Gulf of St. Lawrence, is treated as *Zigadenus chloranthus* Richardson or, by those who do not like genera of many species, as *Anticlea chlorantha* (Richardson) Rydb., while *Z. elegans* Pursh or *A. elegans* (Pursh) Rydb. is, correctly, treated as a more western species. The characters used to separate the two plants as given by Rydberg (Fl. Prair. and Plains) are

Petals and sepals white or straw-colored, greenish only on the midrib, not clawed .... 1. *A. elegans.*
Petals and sepals greenish, the former more or less contracted into a broad claw .... 2. *A. chlorantha.*

If these were the only differences the two would surely not be specifically separable, especially since the "white or straw-colored" sepals and petals become in Rydberg's fuller statement "dirty-white"; accordingly, with only these differences commonly stated, in the 2nd edition of the Illustrated Flora Dr. Britton united them. Having known the eastern plant both in the field and in the herbarium since I first collected it in 1902, I have noted several characters in addition

Photo. E. C. Ogden.

ZIGADENUS GLAUCUS: FIG. 1, flowering plant, × ⅖; FIG. 2, portion of inflorescence, showing firm bracts, × 2; FIG. 3, capsule, × 2.
Z. ELEGANS: FIG. 4, flowering plant, × ⅖; FIG. 5, portion of inflorescence, showing scarious bracts, × 2; FIG. 6, capsule, × 2.

Photo. E. C. Ogden.

Ribes Cynosbati: fig. 2, fruiting branch, × 1.
R. Cynosbati, var. atrox: fig. 1, fruiting branch, × 1.

to color of perianth which indicate that there is a western species, *Zigadenus elegans* Pursh (1814) and an eastern one, *Z. glaucus* Nuttall, based nomenclaturally on *Melanthium glaucum* Nutt. Gen. i. 232 (1818), the plant erroneously identified with *Z. chloranthus* Richardson (1821). Nuttall's *Melanthium glaucum* was primarily the plant of the St. Lawrence system.

HAB. On the gravelly banks of the St. Lawrence in calcareous soil; around the Cataract of Niagara, on the borders of Lakes Erie, Huron and Michigan and up the Missouri to Fort Mandan. . . . Flowering in July and August.

All the localities cited, except the Missouri River one, are those of the eastern plant; and the flowering period, "July and August," is that of the plant growing from Lakes Superior and Michigan to the Gulf of St. Lawrence. When, in 1834, Nuttall transferred *Melanthium glaucum* to *Zigadenus*, he had in hand the western paler-flowered *Z. elegans*, as clearly demonstrated by the acute leaves, the color of the flowers and the locality:

107 ZIGADENUS *glaucus;* MELANTHIUM *glaucum*, Nutt. Gen. Am. 1, p. 232. . . . Leaves . . . acute, and a little shorter than the scape which contains about seven flowers; the flowers white, with greenish claws. . . . *Hab.* Towards the sources of the Missouri . . . the flower is decidedly more white than any other color.—Nutt. Journ. Acad. Phil. vii. 56 (1834).

Even though Nuttall at first confused the plant of the St. Lawrence with the prairie species and later described the latter alone, the original *Melanthium glaucum*, the nomenclatural type, was primarily the eastern plant. Since the western element already had a name, *Zigadenus elegans* Pursh, the name *Z. glaucus* should be retained for the eastern element which Nuttall originally primarily intended. This was the decision of Gray, Man. 499 (1848) and in later editions; and *Z. glaucus* may be considered satisfactorily typified. As to *Z. chloranthus* Richardson, Frankl. Narr. 1st Journ. App. 786 (1821), the description is inconclusive, but it came from a region where *Z. elegans* abounds. At any rate its specific name is antedated by those of both *Z. elegans* and *Z. glaucus*.

Returning to the distinctions between the two species, I summarize them as follows.

Middle and upper bracts of inflorescence herbaceous, tapering to firm subulate tips; sepals and petals strongly suffused on the back with green, bronze or purple; capsule ovoid-conic, 1–1.4 cm. long, 5–8 mm. in diameter, barely exceeding the finally connivent perianth; leaves coriaceous, mostly blunt or subacute; inflorescence a few-forked elongate-lanceolate to open-ovoid panicle (rarely a simple raceme).—Calcareous gravel, cliffs, shores and bogs, chiefly of the St. Lawrence drainage, Mingan Islands and Anticosti, Quebec, to Minnesota, south to northern New Brunswick, western New York, northern Ohio, northern Indiana and Illinois. Flowering from mid-July to September . . . . *Z. glaucus*

Middle and upper bracts of inflorescence with scarious margins and summits; sepals and petals paler, with or without a darkened area at base or middle on the outside; capsule lance-conic, 1.3–2.2 cm. long, 4–6 mm. in diameter, twice as long as perianth; leaves thinner, usually sharply pointed; inflorescence a slender loosely cylindric raceme (rarely a panicle).—Prairies, meadows and calcareous rocks, Alaska to Arizona and New Mexico, eastward to Manitoba, Minnesota, Iowa and Missouri. Flowering from early June into July (in Rocky Mts. to August) . . . . *Z. elegans.*

Plate 361 shows characteristic plants of the two species, × 2/5, with details of bracts and fruits, × 2; the habit of *Z. elegans* photographed from a Wyoming specimen (*Payson & Armstrong*, no. 3774), that of *Z. glaucus* from a Michigan plant (*Ehlers*, no. 648).

As to flowering period the following data from the specimens in the Gray Herbarium are pertinent:

Zigadenus elegans

Manitoba: *fr.* July 17
Minnesota: *fl.* June 13–21
Iowa: *fl.* and young *fr.* July 6
Missouri: young *fr.* July 27
North Dakota: *fl.* July 3–7
South Dakota: *fl.* June 9–30
Saskatchewan: *fl.* June 28–July 13
Alberta: *fl.* June 19–August 16 (Rocky Mts.)
Montana: *fl.* June 13–August 11; *fr.* June 13–August 29
Idaho: *fl.* July 11–August 1
Wyoming: *fl.* June 29–August 8; *fr.* August 29
British Columbia: *fl.* June 22–August 10
Yukon: *fl.* June 29–July 18
Alaska: *fr.* July 31

Zigadenus glaucus

Quebec: 1st *buds* unexpanded July 10–August 16; *fl.* July 16–September 9; *fr.* August 15–September.
New Brunswick: *fl.* July 30
New York: *fl.* August 10–15
Ontario: *fl.* July 16–August 22
Michigan: *fl.* July 21–September 27
Ohio: *fl.* July 7 and 8
Wisconsin: *fl.* July 28
Illinois: *fl.* July 24–August 3
Minnesota: *buds* and 1st *fl.* July

Maianthemum canadense Desf., var. interius Fern. Ontario: sandy Jack Pine barrens, Nairn, no. 3234; under *Thuja*, woods on limestone pavement and gravel, Great Cloche Island, no. 3235.

When I described var. *interius*, Rhodora, xvi. 211 (1914), we knew it in Ontario only from north of Lake Superior. In his *Notes on the Range of Maianthemum canadense and its Variety interius*, Rhodora, xxviii. 9–11 (1926), Butters cited no other Ontario stations and concluded that the large, pubescent variety "is distinctly a plant of the deciduous forest . . . it barely encroaches on the northeastern belt of coniferous forest, and when it does enter this region it is in company with the typical trees and herbs of the deciduous woodlands . . . It appears, therefore, that this essentially western variety, *M. canadense*, var. *interius*, occurs sparingly eastward along the south side of the Great Lakes." It is evident, now, that it follows eastward also along the *north* side of Lake Huron and that it is there in rather boreal surroundings. On the sandy plain near Nairn the plants in the open were mostly sterile but in the shade of *Pinus Banksiana* they were freely flowering and up to 3 dm. high; on Great Cloche Island it was associated with *Carex concinna, C. capillaris, C. scirpoidea* var. *convoluta, Habenaria unalascensis* and other decidedly boreal species in glades among *Thuja occidentalis,* and it there also reached a height of 3 dm.

Cypripedium arietinum R. Br. Ontario: glades among *Thuja,* on limestone pavement, Cloche Peninsula, no. 3247.

Many fruiting plants, with abundant capsules of the preceding year.

Habenaria unalascensis (Spreng.) Wats. Ontario: arbor vitae thickets on the limestone pavement, Great Cloche Island, no. 3251.

Heretofore known between the Rocky Mountains and Anticosti only from somewhere in northern Michigan ("Lake Superior, June, 1860," *Wm. Boott* in Gray Herb.) and the Fishing Islands and adjacent mainland of Bruce Co., Ontario.

Polygonum achoreum Blake, Rhodora, xix. 232 (1917). Blake cited only a single station in Quebec (in Gaspé Co.) and none in Ontario for this northern segregate from *P. erectum* L. It is generally dispersed in open clay soil north to Lake St. John, Temiscaming and the region north of Lake Huron. Our collection is Ontario: clay of roadside near Markstay, Sudbury District, no. 3291.

P. Douglasii Greene. Ontario: about calcareous ledges (with the western *Epilobium paniculatum*) in dry woods, south of Little Current, Manitoulin Island, no. 3292. Michigan: wind-swept crests, crevices and talus of sandstone-conglomerate, West Bluff, Keweenaw Co., no. 3293.

Local east of the Black Hills and the Rocky Mts. Already known from a few stations in Ontario and in Michigan from the islands of Lake Superior.

Cerastium nutans Raf. Ontario: about calcareous ledges in dry woods, south of Little Current, Manitoulin Island, no. 3294.

Macoun cites stations on Lakes Ontario and Erie but none from Lake Huron; but it is represented in the herbarium of the University of Toronto from Go-Home Bay.

Ranunculus fascicularis Muhl. Ontario: peaty pocket in limestone pavement and gravel, Great Cloche Island, no. 3302.

The Ontario stations cited by Macoun are all much further south.

Thalictrum confine Fern. Michigan: glades and openings in thicket bordering calcareous beach of Lake Michigan, east of Manistique, no. 3306.

I find no previous record from the state. For contrast of characters with the western *Thalictrum venulosum* Trel. see Fernald, Mem. Amer. Acad. xv. 279 (1925).

Anemone cylindrica Gray. Michigan: open limestone ledges north of Garden, Delta Co., no. 3308.

Apparently not previously recorded from the Upper Peninsula.

Anemone quinquefolia L., var. **interior**, var. nov., caule superne villoso, villis divergentibus.—Northern Ontario (James Bay) to eastern Manitoba, south to southern Ontario, Ohio, Michigan, Illinois and Iowa. Type: forest, ravine along Pidgeon River, north shore of Lake Superior, Minnesota, July 4, 1924, *Butters & Rosendahl*, no. 4612 (in Gray Herb.).

Familiar with the typical eastern *Anemone quinquefolia*, with the stems glabrous or at most very sparsely appressed-pilose near the involucre, which occurs from eastern Quebec and New Brunswick to North Carolina and across New York locally to Ohio, we were puzzled by the young paler green 1-leaved plants and over-ripe 3-leaved individuals past fruiting, which we found in the dry thickets of northern Michigan. It proves, however, that nearly all material of *A. quinquefolia* from the Great Lakes region north to James Bay has the stems of the flowering plants spreading-villous as are the petioles of the leaves of the 1-leaved young plants and often the petioles of the involucral leaves and the peduncles of the flowers. Var. *interior* is, then, a well defined inland variety, somewhat comparable with *Maianthemum canadense*, var. *interius* Fernald.

I am aware that a Michigan plant, presumably belonging with *Anemone quinquefolia*, var. *interior*, was set off on the basis of its 2-leaved (instead of 3-leaved) involucre as *A. quinquefolia*, var. *bifolia* Farwell, Papers Mich. Acad. Sci. Arts, Let. i. 94 (1923). To take up Farwell's name for the plant with normally 3-leaved involucres which occurs through central-eastern Canada and the Great Lakes states would be quite misleading and unjustified. Var. *bifolia* is an aberration, not a true geographic variety. Individuals with 2 or 4, instead of the usual 3 leaves to the involucre are occasionally found in the more eastern plant with glabrous stems. One collection (purposely made) from Cambridge, Massachusetts, shows 2, 3 or 4 involucral leaves, and several New England collections show aberrant individuals with 2 or 4 leaves, in all cases collected with the normal 3-leaved type. The selected individuals with 4 leaves have not yet been deemed worthy a latin name; neither have the juvenile plants which have only 1 leaf.

DRABA ARABISANS Michx. MICHIGAN: wind-swept sandstone-conglomerate crest of Lookout Mt., Keweenaw Co., no. 3316. Passing into

D. ARABISANS, var. CANADENSIS (Brunet) Fern. & Knowlt. MICHIGAN: with the above, no. 3317.

The first station on the mainland of Keweenaw Co., already recorded in RHODORA, xxxvi. 356 (1934).

D. LANCEOLATA Royle (*D. cana* Rydb.). MICHIGAN: crevices and talus of limestone cliff, Burnt Bluff, Delta Co., no. 3318.

The only Michigan station known; recorded in RHODORA, xxxvi. 359 (1934).

DESCURAINIA INTERMEDIA (Rydb.) Daniels (*Sophia intermedia* Rydb.). ONTARIO: limestone pavement and gravel, Great Cloche Island, no. 3322. MICHIGAN: crevices and talus of limestone cliff, Burnt Bluff, Delta Co., no. 3323.

Probably the plant listed by Walpole (Pap. Mich. Acad. vi. 326) as *Sophia pinnata* from the Lower Peninsula of Michigan. Recorded by Macbride (as *Sisymbrium brachycarpon*) in RHODORA, xvii. 140 (1915) from southern Ontario only.

CARDAMINE PARVIFLORA L., var. ARENICOLA (Britton) O. E. Schulz; Fernald, RHODORA, xxix. 192 (1927). ONTARIO: crevices and talus of hornblendic cliffs and ledges, Cloche Peninsula, no. 3328.

North of previously cited Ontario stations, this is the first locality in the Province represented in the Gray Herbarium. Owing to the past confusion of species in the genus it is probable that the old records need careful scrutiny.

HEUCHERA RICHARDSONII R. Br., var. GRAYANA Rosend., Butt. & Lak. RHODORA, xxxv. 117 (1933). MICHIGAN: sand plain south of Iron Mountain, Dickinson Co., no. 3355.

The range given by Rosendahl, Butters & Lakela, "from Kansas to Indiana and northward to central Wisconsin and southeastern Minnesota" does not include the Upper Peninsula of Michigan.

RIBES CYNOSBATI L., var. **atrox** (TAB. 362, FIG. 1), var. nov., ramibus fructiferis crassis ramulisque densissime retrorso setosis; baccis setosissimis.—ONTARIO: about calcareous ledges in dry woods, south of Little Current, Manitoulin Island, June 29, 1934, *Fernald & Pease*, no. 3358.

It would be difficult to find a more fiercely armed Gooseberry than that of Manitoulin Island. Typical *Ribes Cynosbati* (FIG. 2) has the slender fruiting branches smooth or merely with 1–3 nodal prickles, the berries more or less prickly but not so extremely armed as in var. *atrox*. In the material at the Gray Herbarium of *R. Cynosbati* I find none with the stout and stiff branches nor with anything approaching the bristliness of var. *atrox*. In the Canadian National Herbarium there is a mild approach to it in a specimen from Wingham, Ontario, *J. A. Morton*, no. 749.

AMELANCHIER HURONENSIS Wiegand, RHODORA, xxii. 150 (1920). ONTARIO: crevices and talus of hornblendic cliffs and ledges, Cloche Peninsula, no. 3364. MICHIGAN: trees 3–4 m. high at border of woods along Lake Superior, Bête Grise, Keweenaw Co., no. 3361.

Not recorded by Wiegand, though to have been expected, from the Lake Huron region of Ontario.

A. INTERMEDIA Spach. See Wiegand, l. c. 147 (1920). MICHIGAN: trees 6 m. high at border of woods along Lake Superior, Bête Grise, Keweenaw Co., no. 3362.

When he revived Spach's species Wiegand had seen it in the Alleghenian region from Vermont to western New York, south to North Carolina. Subsequently, RHODORA, xxiii, 103, I extended its range eastward to Nova Scotia and Prince Edward Island. The tree at Bête Grise is very abundant and characteristic.

(To be continued)

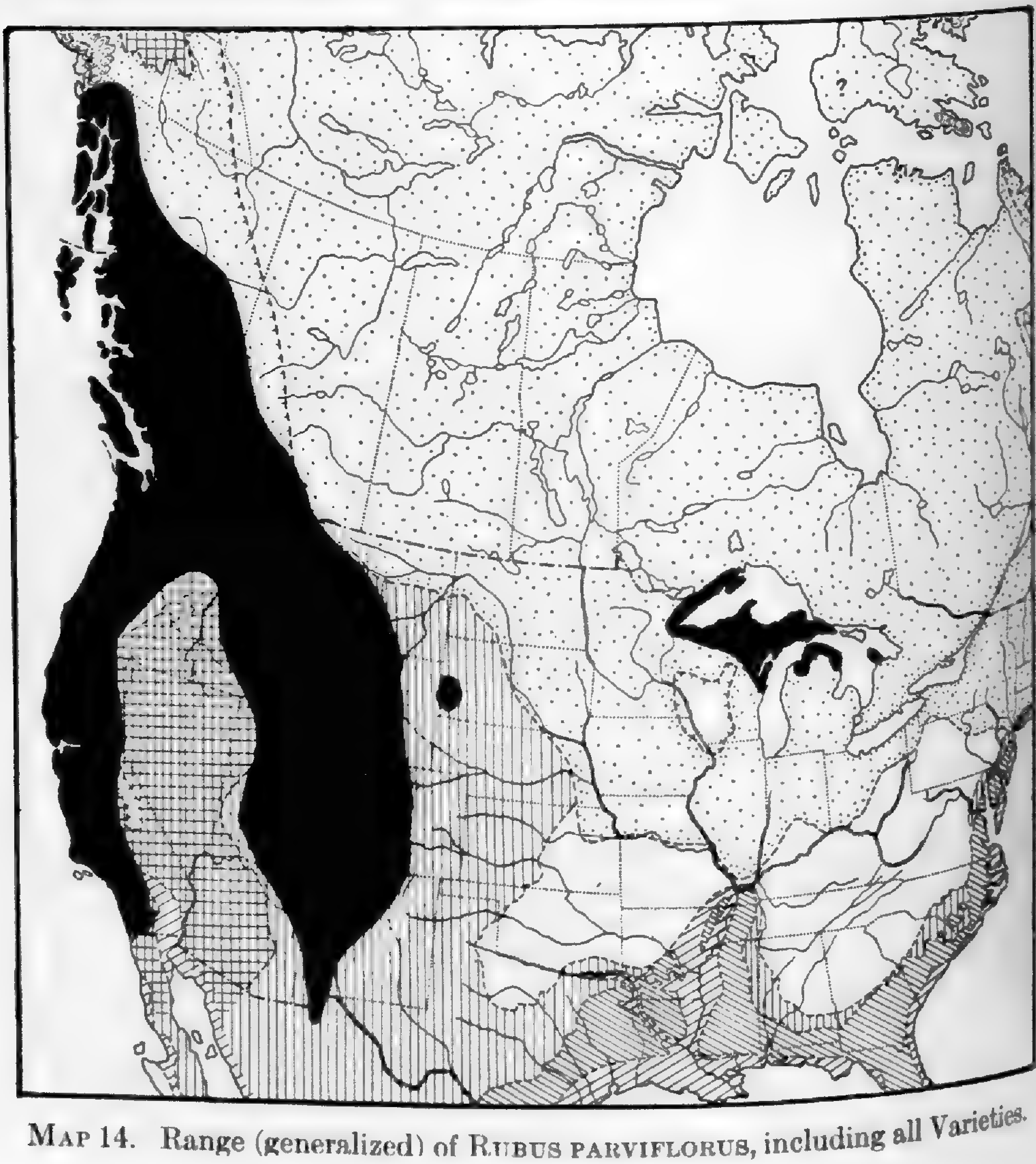
CRITICAL PLANTS OF THE UPPER GREAT LAKES REGION OF ONTARIO AND MICHIGAN

M. L. Fernald

(*Continued from page 262*)

Crataegus Douglasii Lindl. Ontario: shore of Lake Superior, Agawa Bay, Algoma Distr., *Pease*, no. 18,050. Michigan: wind-swept sandstone-conglomerate crest of Lookout Mt., Keweenaw Co., no. 3374.

Already known from northern Michigan, from Michipicoten Island, Lake Superior (Thunder Bay Distr., Ontario) and from Abitibi River (between outlet of Lake Abitibi and mouth of Black River—Nat. Herb., Ottawa) in Cochrane District. Otherwise known as a typical shrub or small tree of the Pacific slope (California to southern British Columbia) eastward across Idaho to western Montana and Wyoming.



Map 14. Range (generalized) of Rubus parviflorus, including all Varieties.

Photo. H. G. Fernald.

RUBUS PARVIFLORUS, . . . ON KEWEENAW PENINSULA.

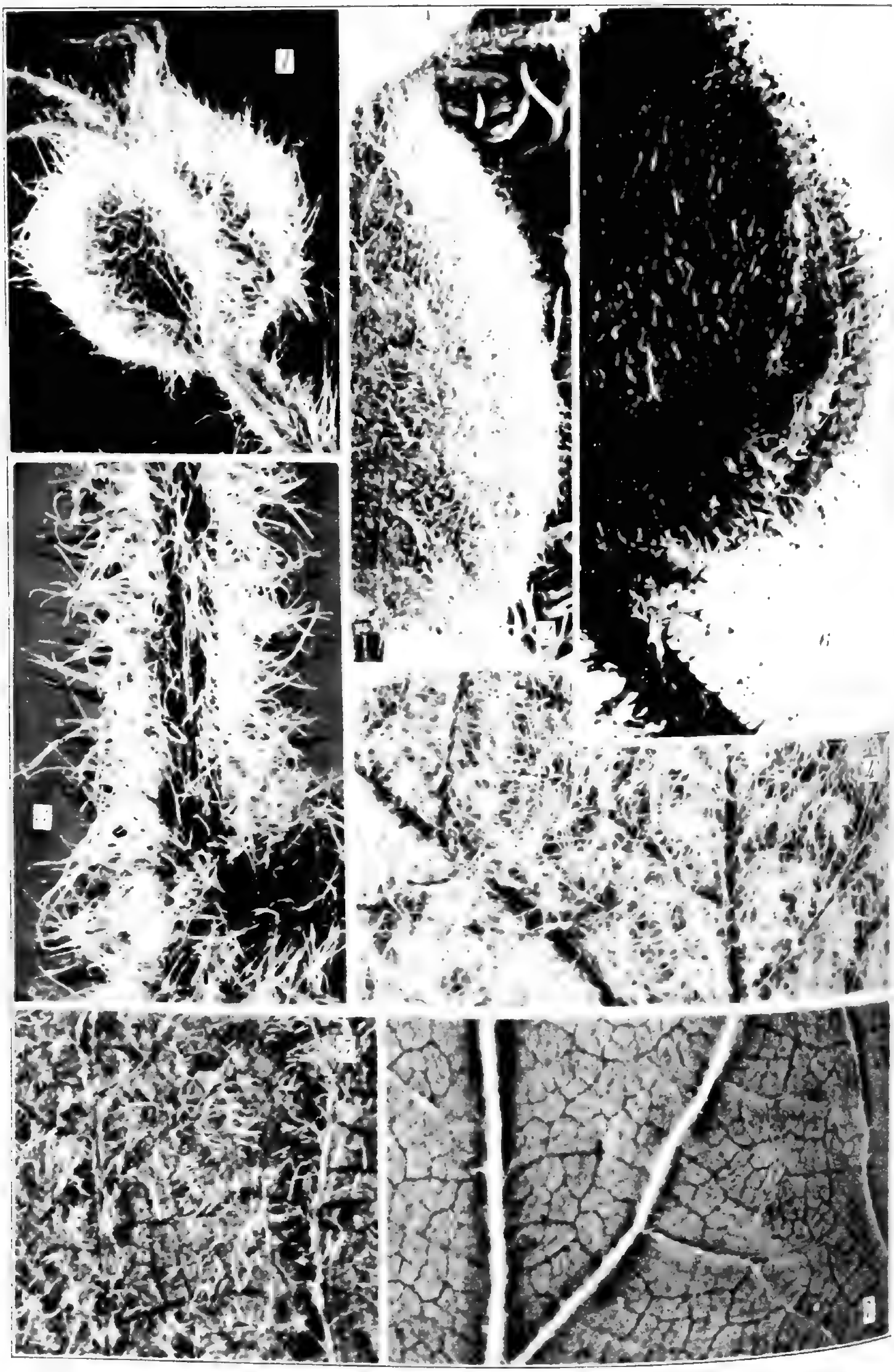


Photo. E. C. Ogden.

VARIETIES OF RUBUS PARVIFLORUS: all figs. × 10.
Var. GENUINUS: FIG. 1, young calyx; FIG. 2, portion of sepal; both from Michigan.
Var. VELUTINUS: FIG. 3, peduncle; FIG. 4, lower surface of leaf; both from California.
Var. HYPOMALACUS: FIG. 5, lower surface of leaf from Washington (TYPE).
Var. HETERADENIUS: FIG. 6, pedicel and calyx, from British Columbia; FIG. 7, lower surface of leaf, from Washington (TYPE).

Rubus parviflorus and its Varieties (Plates 363–365).—The beautiful white-flowered *Rubus parviflorus* Nutt. (Plate 363), the "Thimbleberry" of the Upper Great Lakes region, is there isolated from the Black Hills and the Rocky Mountains, whence it extends to the Pacific, where it is better known as "Salmon Berry." Realizing the improbability that a species of *Rubus* would remain constant or unvarying over the vast and diverse area (map 14) from the coast of southern Alaska to southern California and throughout much of the cordilleran region southward into Mexico and isolated about the Upper Great Lakes, I have felt it important to study with care the large accumulation of material in the Gray Herbarium; and as the study progressed I have borrowed the material from the two Great Lakes states most concerned, Michigan and Wisconsin, and here express my appreciation to Professors Ehlers, Darlington and Fassett for the use of the extensive collections in their charge, which have proved indispensable in working out the variations which reach "the Manual range." It would have been advantageous to see more extensive collections from the Rocky Mountain area and the Pacific slope but the immediate problem chiefly concerned the shrub of Ontario, Michigan, Wisconsin and Minnesota; and the treatment here proposed may readily be adapted to the more continuous western region.

Focke, treating the species as *Rubus nutkanus* Moçino (1825) instead of *R. parviflorus* Nutt. (1818), recognized three varieties but, even with these removed, he described the inflorescence with "setae glanduliferae nunc flexilis, longae, glutinosa, nunc brevissimae, ita ut glandulae subsessiles evadant."[1] And Rydberg, although separating *R. parviflorus* and *R. odoratus* L. as a genus *Rubacer* Rydb. (1903), set off from *R. parviflorus* only one of its eight components and that as a species, *Rubacer tomentosum* Rydb., a renaming of *Rubus velutinus* Hook. & Arn. (1832), not Vest (1823). For the remaining highly variable elements of *Rubus parviflorus* Rydberg described the "inflorescence more or less glandular hispid and often more or less puberulent,"[2] overlooking the significant fact that the "more . . . glandular" inflorescences do not occur in the Rocky Mountains, while the "less glandular" ones (to the extent of complete loss of glands) are restricted to the Rocky Mountain region and are absent from the Pacific coastal region and from the Great Lakes area.

In fact, a study of the indument of pedicels, calyx and leaf-surfaces

[1] Focke, Biblioth. Bot. lxxii. 124 (1911).
[2] Rydb. N. Am. Fl. xxii. 426 (1913).

shows that *Rubus parviflorus* consists of at least eight more or less localized trends, quite comparable with the geographic varieties of *R. idaeus*,[1] which Rydberg, in the North American Flora, maintains as twelve species separated on parallel differences in the indument. It is, furthermore, a disconcerting but indisputable fact that these very differences in the distribution of glands in the inflorescence and of pilosity on the calices, branches and leaves or the absence of glands and pilosity from these areas, which mark the eight geographic segregates of *Rubus parviflorus*, are precisely the characters which are shuffled and reshuffled to add to the ever increasing score of "species" of Blackberry (*Rubus* § *Eubatus*)! In *R. parviflorus* not even our most ardent advocates of specific segregation, who have felt competent to make generic segregates, have noticed them; nevertheless, they are quite as conspicuous in *R. parviflorus* as in segregates of *Rubus* § *Eubatus*, and if their phylogenetic importance is of equal value in the two sections, the Blackberries are eventually due for a pretty drastic realignment.

The greatest extremes in the series of intergrading varieties of *Rubus parviflorus* are var. *velutinus* (Hook. & Arn.) Greene (PLATE 364, FIGS. 3 and 4) and var. *scopulorum* (Greene) (PLATE 364, FIG. 5). The former has the leaves pilose on both surfaces, very densely so and somewhat whitened beneath; the branchlets and pedicels long-pilose or villous among the elongate, dark glands; the calyx densely villous on the outside, the villi overtopping and mostly hiding the glands. This extreme is confined to the Pacific Slope, mostly of California; but also on the Pacific slope we find other variations connecting gradually with series with glabrous leaves, pedicels glabrous or short-pilose and with very short glands, and calyx glandular or glandless and not villous. East of the range of var. *velutinus* there occurs var. *scopulorum*, with leaves quite glabrous beneath, the pedicels quite glandless or with minute and scattered sessile glands; and in the southern Rocky Mountains var. *scopulorum* gives way to a dwarf extreme, var. *parvifolius* (Gray) (PLATE 365, FIGS. 1–3) in which the leaves are mostly glabrous and the pedicels decidedly so. Contrasted with the reduction or loss of glands in some Rocky Mountain extremes (though a wide-ranging variety with short stipitate glands (PLATE 365, FIG. 4) also occurs there) we have the great development of long stipitate glands (PLATE 364, FIG. 6 and 365, FIG. 4) on much of

[1] For revision of *Rubus idaeus* and some of its varieties see Fernald, Rhodora, xxi. 89–98 (1919).

the material of the Pacific Slope and about the Upper Great Lakes. These varieties need not here be discussed but it becomes necessary to determine the exact significance of the two original specific names, *R. parviflorus* Nutt. Gen. i. 308 (1818) and *R. nutkanus* Moçino ex Seringe in DC. Prodr. ii. 588 (1825).

Singularly enough, true *Rubus parviflorus* (var. *genuinus*) is the rarest and most highly localized of the varieties. In view of the prevalence about the Upper Great Lakes of variations with glandular-hispid calices, it is surprising that Thomas Nuttall originally got hold of a very rare extreme, with the calyx densely white-villous, as in the Californian var. *velutinus*. Nuttall, who chose a most unhappy name for one of the largest-flowered species of the genus, gave this account.

* *parviflorus*. Shrubby and unarmed, leaves simple, palmately lobed; peduncles 2 or 3-flowered; flowers small; segments of the calix villous, ovate, abruptly acuminate; petals oblong-ovate, white. Hab. On the island of Michilimackinak, lake Huron.—Nutt. Gen. i. 308 (1818).

Just such a shrub, with the calyx densely white-villous (plate 364, figs. 3 and 4), is represented before me by a specimen collected on Mackinac Island in July, 1881 by T. E. Boyce. I have seen no other material like it from Mackinac Island; but it is in the herbarium of the Michigan State College from a single area (Gogebic Co.) on the Upper Peninsula of Michigan and in that of the University of Wisconsin from three counties in northern Wisconsin. The identity of *R. parviflorus* (var. *genuinus*) is, therefore, clear. Its nearest relative, it is noteworthy, is the Californian var. *velutinus*, rather than the other varieties which occur about the Upper Great Lakes.

The identity of *Rubus nutkanus* is not easily made out from the description. Seringe, taking the name from a manuscript of Moçino, graciously ascribed it to the Spanish botanist; but Seringe's description needs special interpretation. It was as follows:

92. R. Nutkanus (Moç. pl. Nutk. icon.) caule fruticoso inerme glutinoso, ramis teretibus glabris rufis, foliis 5-lobis inaequaliter dentatis floribus subcorymbosis subquanternis, laciniis calycinis ovatis glabris longè acuminatis corallam aequantibus . . . in Americâ boreali. Aff. R. odorato sed pedunculi calycesque glabri. Fl. albi. Fruct. ign.

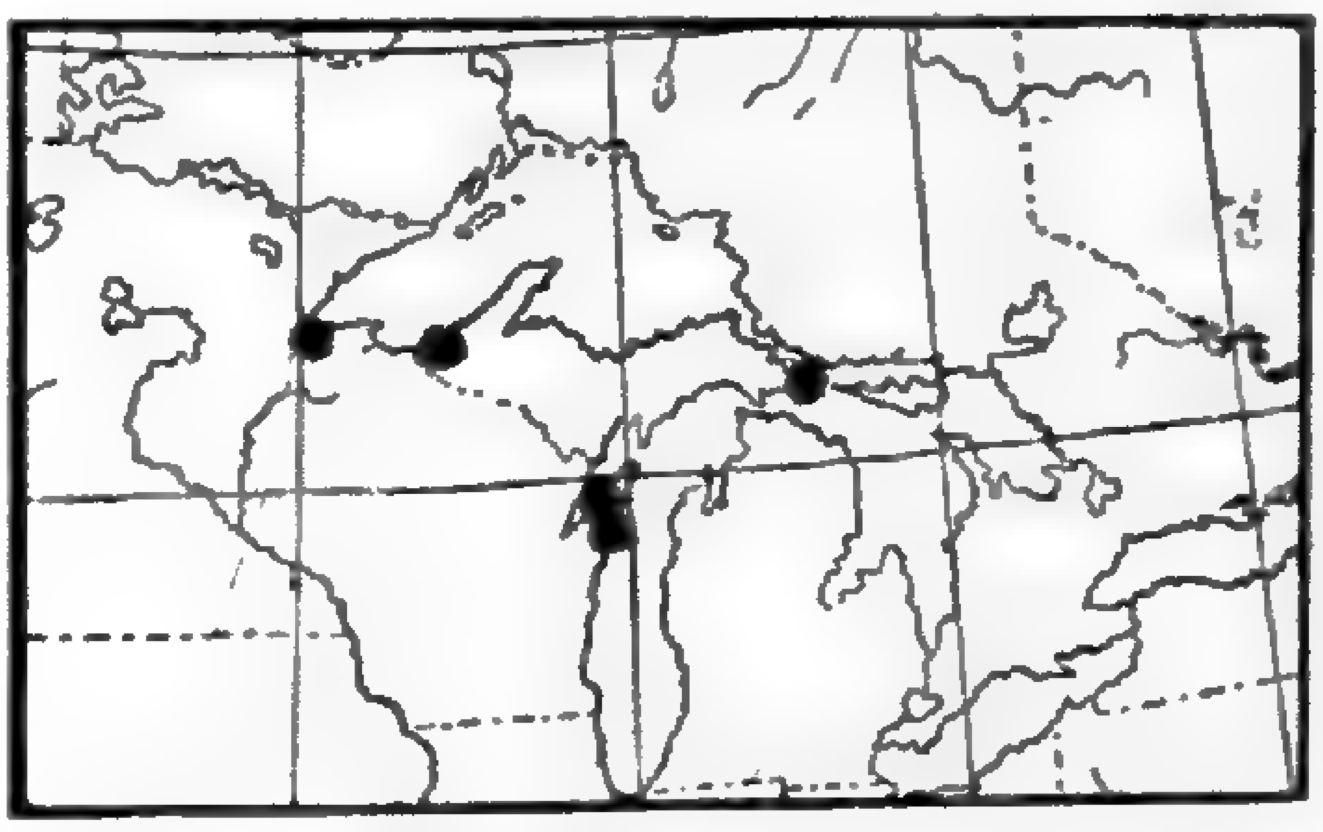
Nootka (or Nutka) Sound is on the west side of Vancouver Island. No form of *Rubus parviflorus* known in the region from Sitka to California has *glabrous* peduncles, all of them being copiously glandular. Consequently, in interpreting the description it is necessary to take into account the romantic and not-too-well-known history of the plates (*icones*) of Moçino and Sessé. Very briefly, these drawings (not botanical specimens), brought by a Spanish student to Geneva and then peremptorily ordered returned to Madrid, were hastily copied by artistically inclined ladies for their friend, A. P. De Candolle; and the many descriptions from the drawings of Moçino and Sessé were actually made, not from the original specimens or even the original drawings, but from the hastily made copies. A tracing of the copy of *R. nutkanus* at Geneva is in the Gray Herbarium. Although not exactly identifiable as to variety, it is certainly *R. parviflorus.* I am accordingly recognizing the plant (PLATE 365, FIG. 4) of the Pacific slope with least obvious pubescence as standing for *R. nutkanus.* In 1929, Farwell, without designating any of the characters used in this paper, substituted for *R. nutkanus* the name *R. parviflorus,* var. *grandiflorus.*

As I view *Rubus parviflorus* it falls into the following geographic varieties. In citing specimens those not in the Gray Herbarium are indicated as follows: University of Michigan (Mich.); Michigan State College (Mich. State); University of Wisconsin (Wisc.); Arnold Arboretum (Arn. Arb.).

a. Glands of the pedicels all or nearly all stipitate....*b.*
b. Calyx-lobes densely long-villous with pale trichomes hiding the glands; leaves mostly soft-pubescent to touch beneath; glands of pedicels long and unequal.
Petioles and young branches sparsely short-pilose to glabrous except for the stipitate glands; leaf-blades glabrous or glabrate above, green beneath........1. Var. *genuinus.*
Petioles and young branches copiously long-pilose to villous among the glands; leaf-blades soft-pubescent to touch above, the young whitish-velutinous beneath....................................2. Var. *velutinus.*
b. Calyx-lobes puberulent, minutely tomentulose or glandular-hispid, not long-villous....*c.*
c. Glands of pedicels and peduncles very unequal, mostly dark-colored, the longest often 1–2 mm. long.
Lower surfaces of leaves with soft divergent pubescence (soft to touch) abundant................3. Var. *hypomalacus.*
Lower surfaces glabrate to glabrous, not obviously soft-pubescent to touch.......................4. Var. *heteradenius.*
c. Glands of pedicels and peduncles mostly subequal and short, often pale, rarely more than 0.5 mm. long, longer scattered glands when present rarely more than 1 mm. long.
Lower surfaces of leaves with soft divergent pubescence (soft to touch) abundant...............5. Var. *bifarius.*
Lower surfaces of leaves glabrous or soon glabrate. 6. Var. *grandiflorus.*
a. Glands of pedicels all or nearly all sessile or subsessile or even wanting; leaves glabrous or only minutely and sparsely pubescent beneath.
Shrubs mostly 1–2 m. high; leaves mostly 1–3 dm. broad, glabrous beneath; inflorescences 3–7-flowered, their lowest pedicels 1–3.5 cm. long.......................7. Var. *scopulorum.*

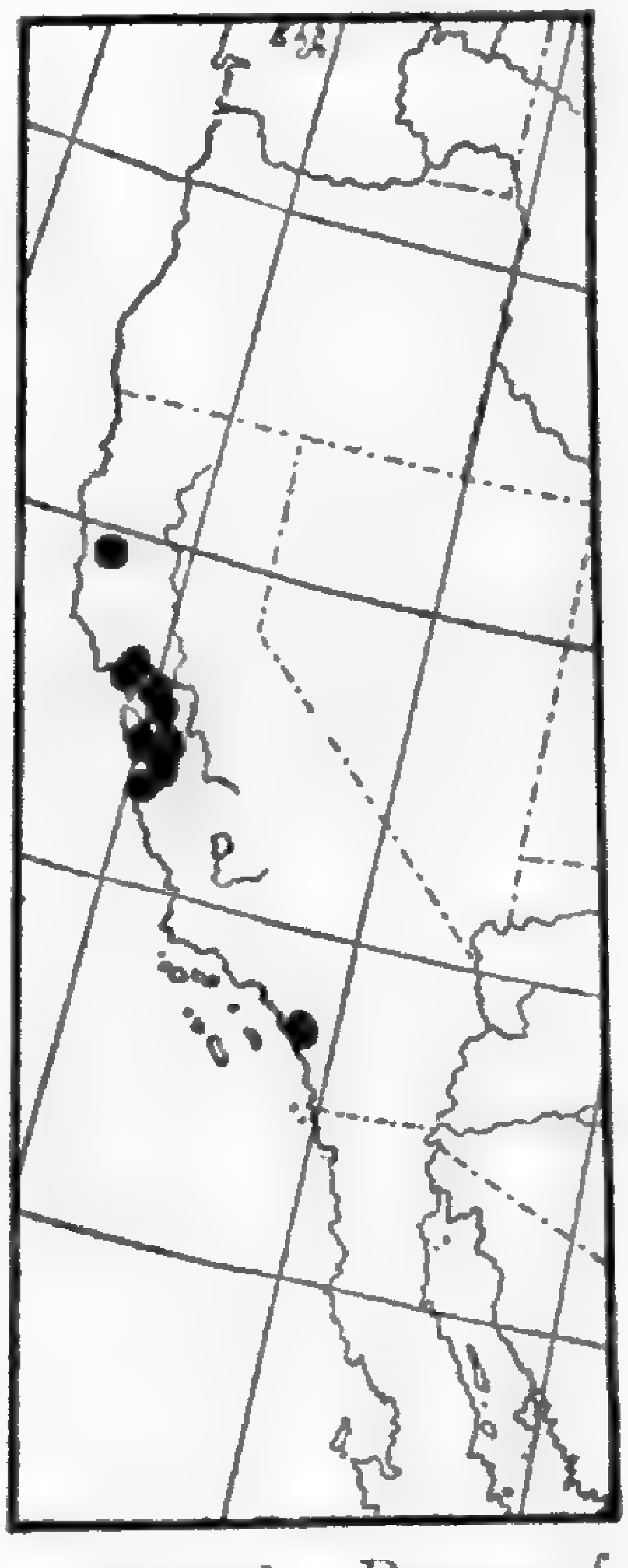
Shrubs 1.5–6 dm. high; leaves 0.5–1.3 dm. broad, minutely and sparsely pubescent to glabrate beneath; inflorescences 1–2 (–4)-flowered, their lowest pedicels 2–6 cm. long. 8. Var. *parvifolius*.

1. Rubus parviflorus Nutt., var. **genuinus** (Plate 364, figs. 1 and 2). *R. parviflorus* Nutt. Gen. i. 308 (1818). *R. nutkanus*, β, *Nuttallii* Torr. & Gr. Fl. N. Am. i. 450 (1840). *Rubacer parviflorum* (Nutt.) Rydb. Bull. Torr. Bot. Cl. xxx. 274 (1903), in small part, but as to type. *Bossekia parviflora* (Nutt.) Greene, Leaflets, i. 211 (1906), as to type. *R. nutkanus*, var. *parviflorus* (Nutt.) Focke, Bibl. Bot. xvii[72]. 124 (1911), as to type.—Localized about the Upper Great Lakes in northern Michigan, Wisconsin (and presumably Minnesota). The following have been studied. Michigan: Mackinac Island, July, 1881, *T. E. Boyce*, no. 783 (topotype); upper reaches of Slate River and surrounding woods, Gogebic Co., August 25, 1919, *H. T. Darlington*, no. 3041 (Mich. State). Wisconsin: Stony Creek, Algoma, Kewaunee Co., July 24, 1929, *J. J. Davis* (Wisc.); Sturgeon Bay, Door Co., July 26, 1929, *J. J. Davis* (Wisc.); Superior, Douglas Co., June 30, 1927, *L. R. Wilson & L. M. Jones*, no. 279 (Wisc.). Map 15.



Map 15. Range of Rubus parviflorus, var. genuinus.

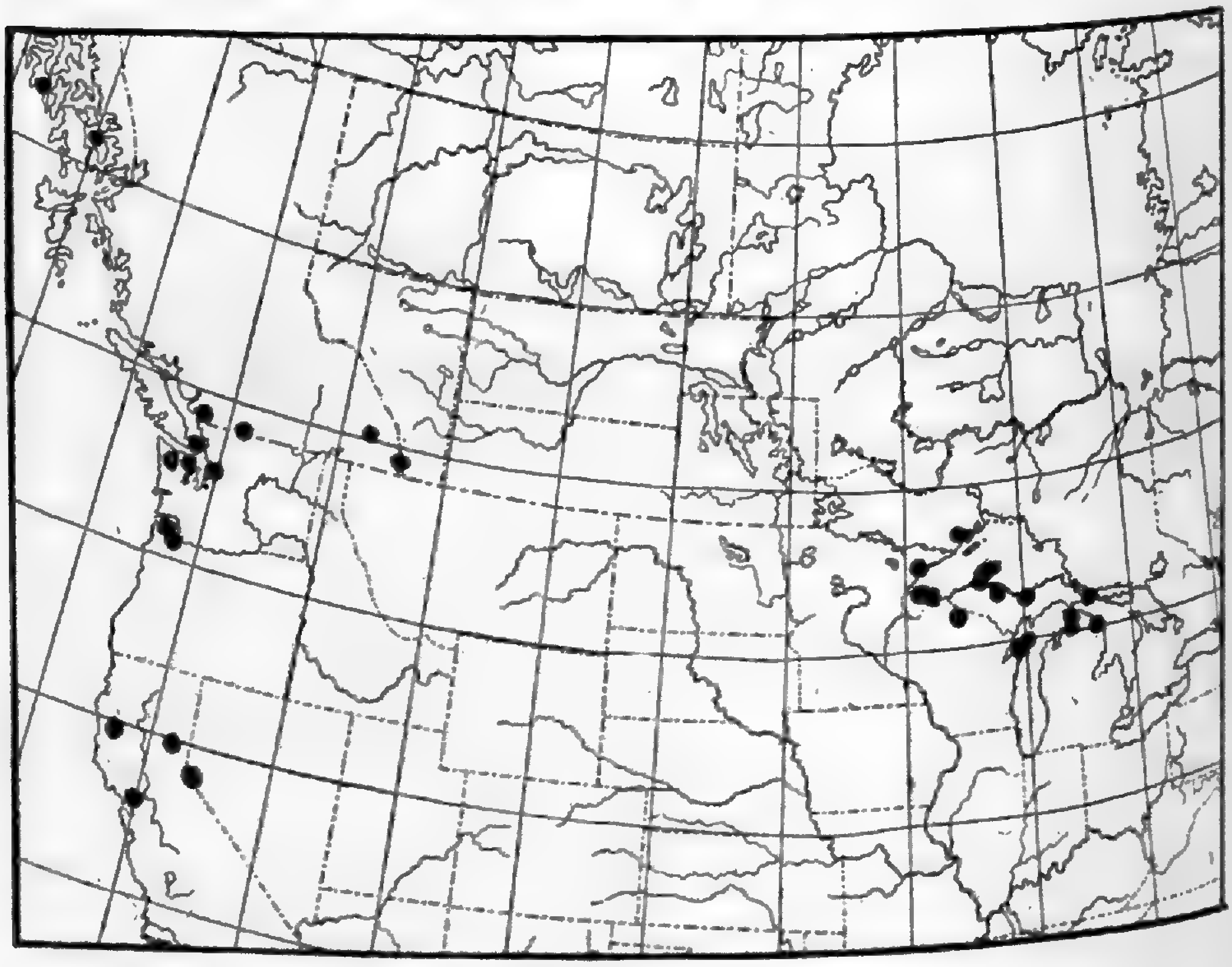
2. Var. velutinus (Hook. & Arn.) Greene, Bull. Torr. Bot. Cl. xvii. 14 (1890) (Plate 364, figs. 3 and 4). *R. velutinus* Hook. & Arn. Bot. Beech. Voy. 140 (1832), not Vest (1823). *R. nutkanus*, var. *velutinus* (Hook. & Arn.) Brewer, Bot. Calif. i. 172 (1876). *Rubacer tomentosum* Rydb. Bull. Torr. Bot. Cl. xxx. 274 (1903). *Rubacer velutinus* (Hook. & Arn.) Heller, Muhlenbergia, i. 106 (1904). *Rubus parviflorus*, var. *grandiflora* [*us*], subvar. *velutinus* (Hook. & Arn.) Farwell, Am. Midl. Nat. xi. 263 (1929).—Coastal region of California. Map 16.



Map 16. Range of Rubus parviflorus, var. velutinus.

3. Var. **hypomalacus**, var. nov. (tab. 364, fig. 5), foliis subtus subvelutinis; pedicellorum pedunculorumque glandulis stipitatis valde inaequalibus plerumque sordidis longioribus ad 1–2 mm. longis.—Southern Alaska to southern California, inland across southern British Columbia to the Canadian Rocky Mountains; about the Upper Great Lakes, northern Michigan, Wisconsin, Minnesota and adjacent Ontario. The following (selected from many specimens) are representative. Michigan: limestone till, Bois Blanc Island, Mackinac Co., *Ehlers*, no. 4852;

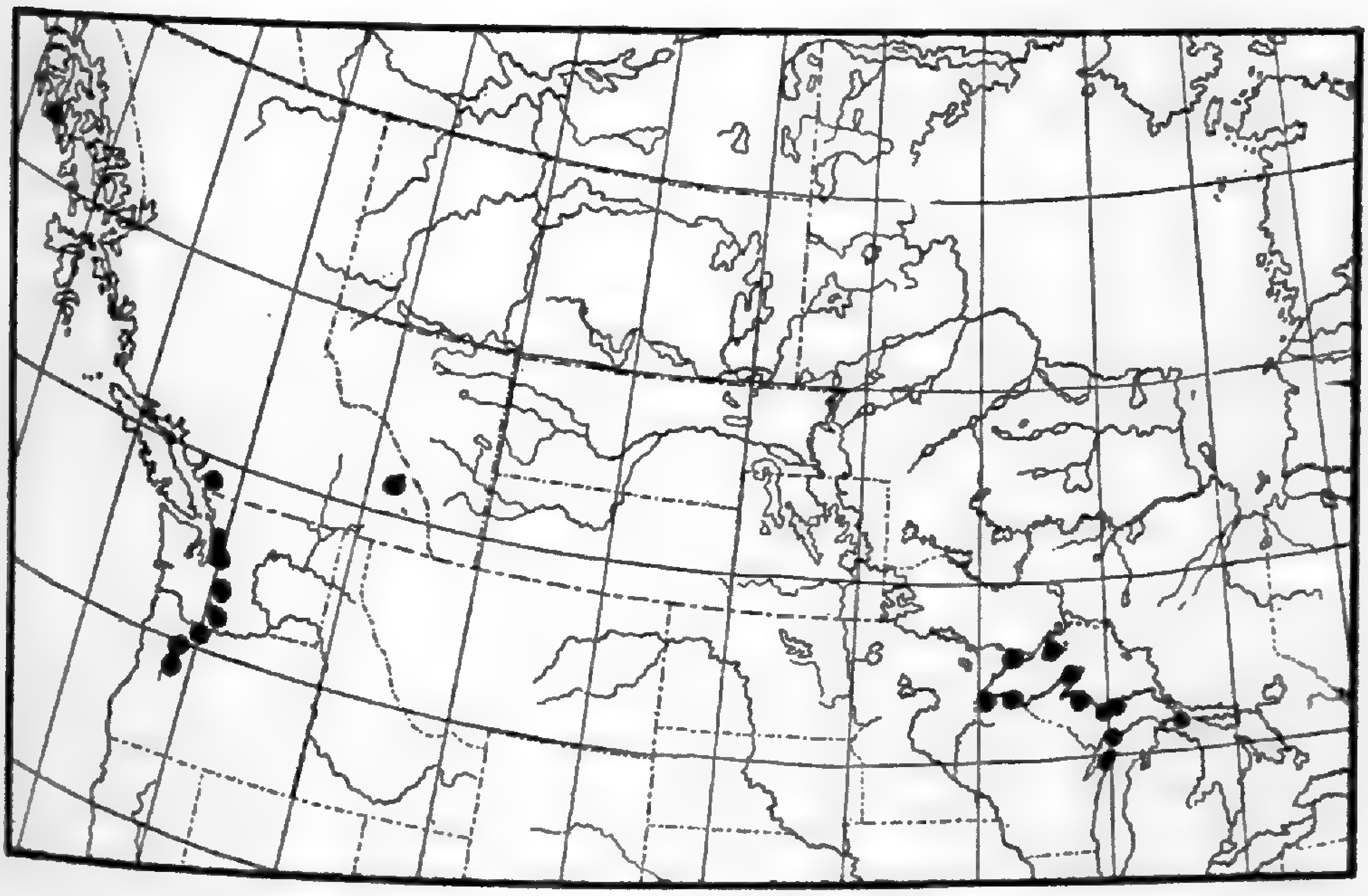
rich deciduous woods above Miner's Falls, near Munising, Alger Co., *Fernald & Pease*, no. 3388; along road to Mt. Mesnard, Marquette Co., August 3, 1906, *Dachnowski* (Mich.); edge of open woods, near Bear Lake, Houghton Co., *Hermann*, no. 389 (Mich.); "in peninsulâ Keweenaw, anno 1863," *J. W. Robbins;* Bête Grise, Keweenaw Co., *Hermann*, no. 337 (Mich.); north shore of Thunder Bay, Alpena Co., July 3, 1895, *C. F. Wheeler* (Mich. State); roadside between Cecil Bay and Big Stone Bay, Emmet Co., *C. O. Erlanson*, no. 303 (Mich.); coniferous woods near Cecil Bay, *Ehlers*, no. 2896 (Wisc.); mixed woods, Big Stone Bay, *Ehlers*, no. 503. Wisconsin: Whitefish Bay, west shore of Lake Michigan, June 22, 1866, *Lewis Foote* (Mich.); woods and fields, Ephraim, Door Co., *Pease*, no. 18,040; Clark Lake, Door Co., August 1, 1929, *J. J. Davis* (Wisc.); bank near Sand Lake, Lac du Flambeau Reservation, Vilas Co., *Fassett*, no. 10,827 (Wisc.); Sand Island, Lake Superior, *L. S. Cheney*, no. 6184 (Wisc.); Washburn, Bayfield Co., June 27, 1910, *E. H. Toole* (Wisc.); woods near Port Wing, Bayfield Co., June 14, 1928, *Griscom*. Minnesota: Two Harbors, Lake Co., June, 1893, *E. P. Sheldon*. Alaska: Stika, *Bongard;* clearing at beach, Tongas Village, *Walker*, no. 891. British Columbia: damp thickets, Kootenai Pass, *Dawson*, no. 139; shore of Howser Lake, Selkirk Mts., *Shaw*, no. 708; Chilliwack Valley, *J. M. Macoun*, no. 34,808; Vancouver, June 25, 1903, *J. Fowler* (Wisc.). Washington: Friday Harbor, San Juan Islands, *Zeller*, no. 757; Port Ludlow, June 15, 1889, *F. Binns;* foothills, Olympic Mts., *J. M. Grant*, no. 211 (type in Gray Herb.);



Map 17. Range of Rubus parviflorus, var. hypomalacus.

fields, Marysville, May, 1924, *J. M. Grant.* OREGON: Ross Slough, Coos Co., *H. H. Smith*, no. 3678; hillsides, Portland, August 30, 1889, *Drake & Dickson.* CALIFORNIA: near John Day's, Mendocino Co., *Heller*, no. 5850; north slopes, Jonesville, Butte Co., *Copeland*, no. 419 (Wisc.); Berkeley, *W. W. Jones*, no. 161. NEVADA: King's Cañon, Ormsby Co., *C. F. Baker*, no. 1097. MAP 17.

In some of its specimens var. *hypomalacus* approaches the Californian var. *velutinus* but it differs in the shorter and more glandular pubescence of the calyx, in the less villous branchlets and, usually, in the sparser pubescence of the foliage. Doubtless var. *hypomalacus* has been the basis of some records of var. *velutinus* from north of California.

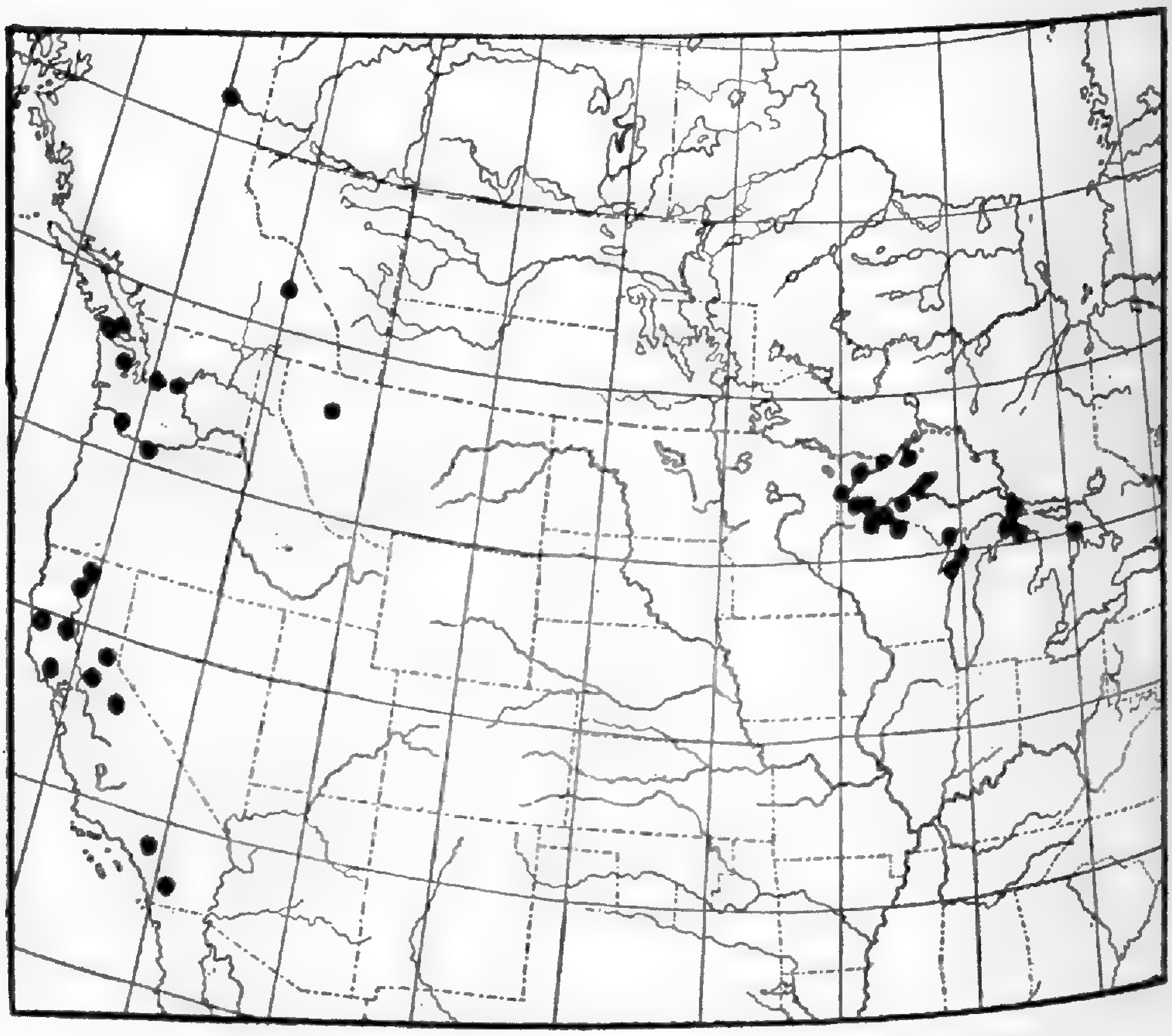


MAP 18. Range of RUBUS PARVIFLORUS, var. HETERADENIUS.

4. Var. **heteradenius**, var. nov. (TAB. 364, FIG. 6), foliis subtus (nerviis exceptis) glabris vel glabratis; pedicellorum pedunculorumque glandulis valde inaequalibus plerumque sordidis longioribus ad 1–2 mm. longis.—Southern Alaska to Oregon and the Selkirk Mts. of British Columbia; region of Upper Great Lakes, Michigan, Wisconsin and Minnesota. The following are characteristic. MICHIGAN: rocky woods, Bois Blanc Island, Mackinac Co., *Ehlers*, no. 4852 (Mich.); Negaunee, Marquette Co., July, 1871, *Mary H. Clark* (Mich.); "in peninsulâ Keweenaw, anno 1863," *J. W. Robbins;* Bête Grise, Keweenaw Co., *Hermann*, no. 337 (Mich.); border of open woods north of Garden, Delta Co., *Fernald & Pease*, no. 3389. WISCONSIN: Door Co., July 1, 1883, *Schuette* (Wisc.); Madeline Island, Ashland Co., *Jackson & Sheldon*, no. 217 (Wisc.); Superior, August 23, 1893, *E. T. Harper* (Wisc.). MINNESOTA: woods and wooded hillsides, near

Hoveland, Cook Co., *Rosendahl & Butters*, no. 4627. Alaska: Sitka, *Bischoff*. British Columbia: Glacier, August 19, 1909, *Olson;* Vancouver, June 8, 1903, *J. Fowler* (Wisc.). Washington: fields, Marysville, May, 1922, *J. M. Grant* (Wisc.); grassy slopes, at 3000–4000 ft., Mt. Paddo, *Suksdorf*, no. 1758; on damp ground, Falcon Valley, June 26, 1893, *Suksdorf*, no. 1758 (type in Gray Herb.). Oregon: Willamette Hills, May, 1892, *Mulford;* along stream, Salem, *J. C. Nelson*, no. 1280. Map 18.

5. Var. **bifarius**, var. nov., foliis subtus subvelutinis; pedicellorum pedunculorumque glandulis stipitatis uniformibus plerumque pallidis vix 0.5 mm. longis.—British Columbia to southern California and northwestern Montana; region of Upper Great Lakes, Ontario, Michigan, Wisconsin and Minnesota. The following are characteristic. Ontario: Cameron Lake, Bruce Co., *Krotkov*, no. 7549. Michigan: open rocky woods, Prentis Bay, Mackinac Co., *Ehlers*, no. 1343 (Mich.); Eureka, Houghton Co., *Hermann*, no. 389 (Mich.); roadside near Silver Isle, Keweenaw Co., *Hermann*, no. 2187 (Mich.); edge of spruce woods near Bête Grise, Keweenaw Co., *Hermann*, no. 337 (Mich.); Isle Royale, 1868, *A. E. Foote* (Mich.); Ontonagan, 1860, *Mary H. Clark* (Mich.); gravel ridges Koss, Menominee Co., July 12, 1905, *C. A. Davis* (Mich.); banks of Limestone Creek, south of Mackinaw City, Cheboygan Co., *Ehlers*, no. 5261; shaded rich ground, near



Map 19. Range of Rubus parviflorus, var. bifarius.

Photo. E. C. Ogden

VARIETIES OF RUBUS PARVIFLORUS; habit, × 2/5, details, × 10.
Var. GRANDIFLORUS: FIG. 4, pedicel and calyx, from South Dakota.
Var. SCOPULORUM: FIG. 5, pedicel, from Colorado.
Var. PARVIFOLIUS: FIG. 1, 2 plants; FIG. 2, calyx and pedicel; FIG. 3, lower surface of leaf, all from New Mexico.

Photo. E. C. Ogden

Chamaerhodos Nuttallii: fig. 3, branch, × 10, to show pubescence.
C. Nuttallii, var. keweenawensis: fig. 1, plant, × 1, from Keweenaw Peninsula; fig. 2, branch, × 10, to show pubescence.

Grand Lake, Presque Isle Co., June 26, 1912, *C. K. Dodge* (Mich.). WISCONSIN: Washington Island, Door Co., July 3, 1931, *J. J. Davis* (Wisc.); rocky banks of Potato River, Gurney, Iron Co., *Newton Bobb*, no. 272 (Wisc.); Ashland, *Hermann*, no. 294 (Mich.); La Pointe, September, 1858, *Lapham* (Wisc.); mainland east of Sand Bay, Lake Superior, *L. S. Cheney*, no. 6275 (Wisc.); Wisconsin River, Newbold, *Cheney*, no. 1624 (Wisc.). MINNESOTA: opening in hardwoods, Grand Portage, Cook Co., *Butters & Buell*, no. 344; Two Harbors, Lake Co., *Sheldon*, nos. 4938, 5254 (Wisc.); Farquhar Point, Lake Superior, 1870, *J. C. Jones* (Mich.); near Duluth, July 5, 1893, *A. E. Gurd* (Mich.). MONTANA: woods, foot of Kootenai Mts., Big Fork, August 10, 1901, *Umbach*. BRITISH COLUMBIA: rich woods along Wicked River, near the Peace River, *Raup & Abbe*, no. 3800 (Arn. Arb.); banks near Cameron Lake, Vancouver Island, July 14, 1917, *W. R. Carter* (TYPE in Gray Herb.); thickets, District of Renfrew, *Rosendahl & Brand*, no. 3. WASHINGTON: Brinnon, Jefferson Co., *Beattie*, no. 3068 (Wisc.); Snoqualmie, August 8, 1924, *E. J. Kraus* (Wisc.); Kelso, August 8, 1924, *Kraus* (Wisc.); Peshastin, Okanagan Co., *Sandberg & Leiberg*, no. 542. OREGON: open woods, lower Hood River, 1924, *Henderson*, no. 892. CALIFORNIA: near John Day's, Mendocino Co., *Heller*, no. 5850; Goose Valley, Shasta Co., *Eastwood*, no. 883; between Upper Soda Spring and Shasta Retreat, Siskiyou Co., *Heller*, no. 7949; Yosemite Valley, alt. 4000–4500 feet, *Abrams*, no. 4367; wooded north slope, west of Bennett, Glenn Co., *Heller*, no. 11,979; ravine near Fallen Leaf Lake, Tahoe, *Smiley*, no. 361; Big Trees, Calaveras Co., *H. Mann;* vicinity of San Bernardino, alt. 6500 feet, *W. G. Wright*, no. 250; in shade near brook, Idyllwild, San Jacinto Mts., alt. 5300 feet, *M. F. Spencer*, no. 1731. MAP 19.

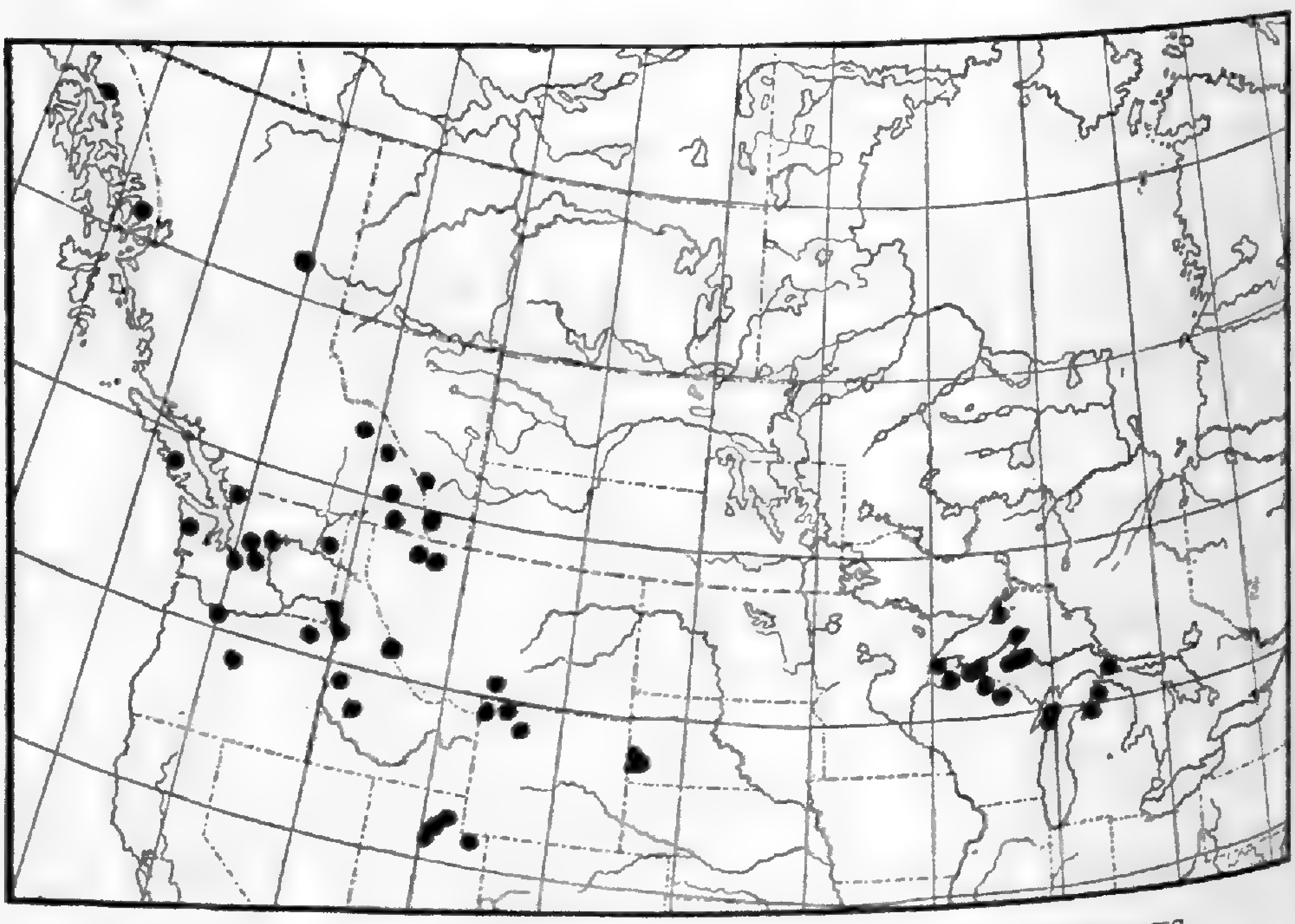
Var. BIFARIUS, forma **lacera** (Kuntze), comb. nov. *R. nutkanus*, f. *lacera* Kuntze, Meth. Sp. 102 (1879).—Vancouver Island, 1858, *Lyall*.

A sheet of the type-collection (in flower) in the Gray Herbarium is clearly a cut-leaved form of var. *bifarius*. Its leaves are cleft only 2/3–3/4 to the base. R. PARVIFLORUS, forma PEDATIFIDUS Hermann, RHODORA, xxxvii. 61, t. 326, fig. 2, has the leaves cleft to the base. It also is a form of var. *bifarius*.

Another form of *R. parviflorus*, presumably belonging to var. *bifarius*, is f. **Fraserianus** (J. K. Henry), comb. nov. *R. parviflorus*, var. *Fraserianus* J. K. Henry, Torreya, xviii. 54, fig. 1 (1918), a plant with leaves "rather densely pilose beneath" and differing from the ordinary forms in having the summits of the petals laciniate-dentate. It is described as "not common" at Ucleulet, Vancouver Island. It must be considered an aberrant form, not a true geographic variety.

6. Var. GRANDIFLORUS (as "GRANDIFLORA") Farwell, Am. Midl. Nat. xi. 263 (1929). (PLATE 365, FIG. 4.) *R. nutkanus* Moçino ex

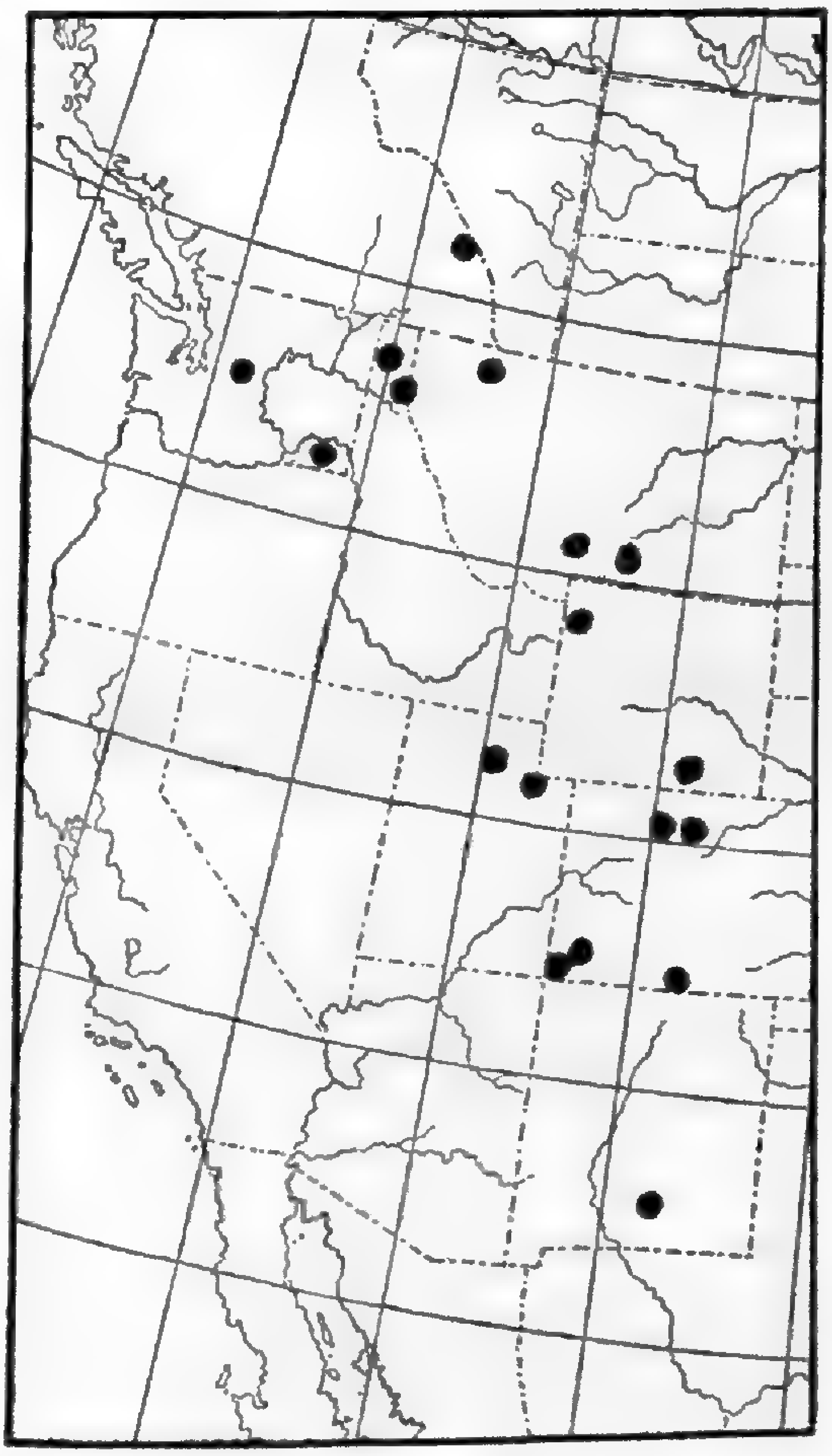
Seringe in DC. Prodr. ii. 566 (1825), inadequately characterized.—Southern Alaska to Oregon, Idaho, Utah and Wyoming; Black Hills, South Dakota; region of Upper Great Lakes, Michigan and Wisconsin (doubtless also Minnesota). The following are characteristic. Michigan: open woods, Prentis Bay, Mackinac Co., *Ehlers,* no. 1349 (Mich.); Marquette, *Pepoon,* no. 1563 (Mich.); shaded ground, Suger Loaf Mt., Marquette Co., July 3, 1916, *C. K. Dodge* (Mich.); L'Anse, Baraga Co., August 29, 1893, *S. R. Bailey* (Mich.); Elk Rapids, June 30, 1902, *Cooper* (Mich. State); Keweenaw Peninsula, 1863, *Robbins;* Isle Royale, *Stuntz & Allen,* no. 102; open woods, Rock Harbor, Isle Royale, *McFarlin,* no. 2004. Wisconsin: sandy woods, Washington Island, Door Co., *A. M. Fuller,* no. 1395 (Wisc.); Door Co., July, 1883, *Schuette;* lower 2 miles of Montreal River, *L. S. Cheney,* no. 5090 (Wisc.); Vilas Co., July 1, 1923, *S. I. Lilygren* (Wisc.); Mt. Whittlesey, Mellen, Ashland Co., *L. R. Wilson,* no. 10,135 (Wisc.); Grandfather Bull Falls, Lincoln Co., *Cheney,* no. 2471 (Wisc.); Drummond, *Cheney,* no. 4144 (Wisc.); Superior, Douglas Co., *Chas. Goessl,* no. 7843 (Wisc.) South Dakota: near Lead City, alt. 5500–6500 feet, *Rydberg,* no. 655; head of City Creek, alt. 5300 feet, *J. Murdoch,* jr., no. 3541; damp ravines, Pluma, *W. P. Carr,* no. 175. Montana: Decent to Ross' Hole, *S. Watson,* no. 103; woods, Midvale, *Umbach,* no. 412 (Wisc.); Lake McDonald, *Vreeland,* no. 933; Emigrant Gulch, *Rydberg & Bessey,* no. 4327. Idaho: copses above Lewiston, *Sandberg, MacDougal & Heller,* no. 300; Lake Waha, Nez Perces Co., June 22, 1896, *Heller* (Wisc.); timbered hillside, Tamarack, Washington Co., *J. A. Clark,* no. 225; creek-bank, Boise, *J. A. Clark,* no. 98. Wyoming: Crandall Creek, Clark's Fork Mts., August, 1881,



Map 20. Range of Rubus parviflorus, var. grandiflorus.

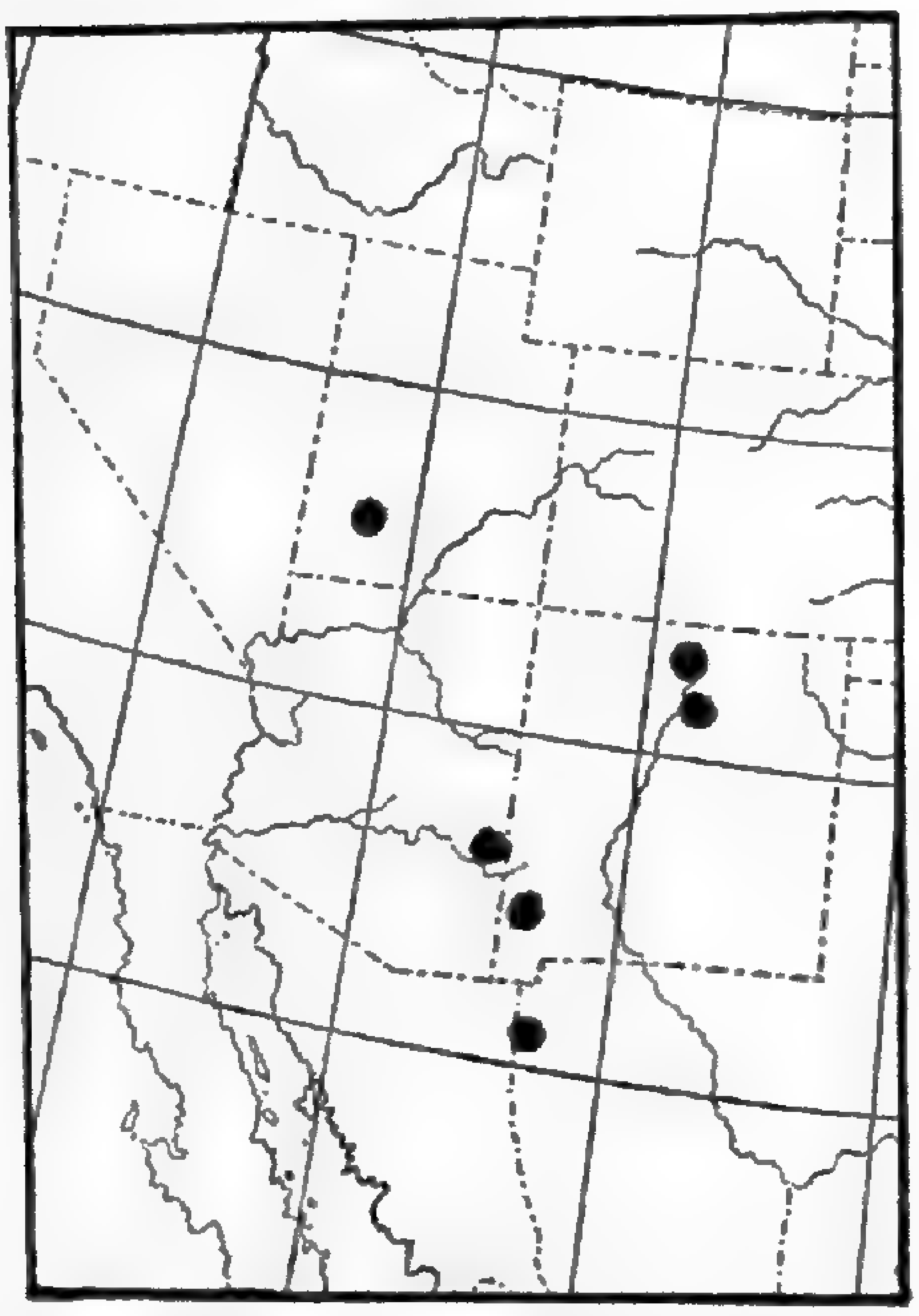
Forwood; wooded cañon, Yancey's, *Nelson & Nelson*, no. 5924. COLORADO: rocky slopes, Rabbit Ear Range, Routt Co., *Goodding*, no. 1596. UTAH: timbered gulch, Dyer Mine, Uintah Mts., *Goodding*, no. 1424; Red Butte Cañon, July 11, 1908, *Mrs. Joseph Clemens;* Wasatch Mts., at 7000 feet, *S. Watson*, no. 308; shady subalpine banks, alt. 8000–10,000 feet, Peterson Cañon, *Pammel & Blackwood*, no. 3803. ALASKA: Wrangell, *Walker*, no. 677; Juneau, June 25, 1899, *L. J. Cole* (Wisc.). BRITISH COLUMBIA: poplar-spruce forest, near head of Rocky Mountain Cañon, Peace River, *Raup & Abbe*, no. 3742 (Arn. Arb.); woods, Emerald Lake, Selkirk Mts., *Shaw*, no. 129; Carbonate, Selkirk Mts., *Shaw*, no. 188; thickets, Donald, July 3, 1885, *J. M. Macoun*. WASHINGTON: Clark Springs, Spokane Co., *Kraeger*, no. 37; mountains above Chelan, *Lake & Hull*, no. 502 (Wisc.) upper valley of the Nesqually, *O. D. Allen*, no. 25; valley of Swauk River, Kittitas Co., *S. P. Sharples*, no. 121; lake-shore, Quiniault, *Conard*, no. 103; Snoqualmie, August 12, 1924, *E. J. Kraus* (Wisc.); Bagley Lake, Whatcom Co., *J. W. Thompson*, no. 5358. OREGON: Mt. Emily, La Grande, Union Co., *H. P. Hansen*, no. 1078 (Wisc.); Crook Co., July 17, 1922, *Whited;* Bridal Veil, Multnomah Co., *H. H. Smith*, no. 3085. MAP 20.

7. Var. **scopulorum** (Greene), comb. nov. (PLATE 365, FIG. 5). *R. nutkanus*, var. *scopulorum* Greene ex Focke, Bibl. Bot. xvii[72]. 124 (1911).—Southeastern British Columbia and central Washington to New Mexico. The following are characteristic. BRITISH COLUMBIA: Kicking Horse Valley, *S. Brown*, no. 481. WASHINGTON: Blue Mts., Columbia Co., *Horner*, no. B164; Snoqualmie, August 12, 1924, *E. J. Kraus* (Wisc.). IDAHO: valley of North Fork of Coeur d'Alene River, *Leiberg*, no. 1525; woods, Sand Point, *Umbach*, no. 424 (Wisc.). MONTANA: coniferous woods, Lake Josephine Trail, Glacier Nat. Park, *McLaughlin*, no. 718 (Wisc.); West Rosebud River, alt. 7000 feet, July 11, 1923, *P. H. Hawkins* (Wisc.); Spanish Creek, Gallatin Co., July 15, 1901, *Vogel*. WYOMING: Jennings Lake, Jackson Hole, *Merrill & Wilcox*, no. 916; Centennial Valley, *Nelson*, no. 1676.



MAP 21. Range of RUBUS PARVIFLORUS, var. SCOPULORUM.

Utah: Big Cottonwood Cañon, Salt Lake Co., *O. A. Garrett*, no. 1685; wooded slope near Stillwater Fork, Uintah Mts., *Payson & Payson*, no. 5147. Colorado: forest, gulch west of Bear River, alt. 7000 feet, *Crandall*, no. 195; headwaters of Clear Creek, *Parry*, no. 211; mountains about Steamboat Springs, Routt Co., July 15, 1902, *G. E. Osterhout* (Wisc.); bottom of La Plata Cañon, *Baker, Earle & Tracy*, no. 680. New Mexico: Sierra Blanca Peak, Otero Co., *C. B. Wolf*, no. 2858. Map 21.



Map 22. Range of Rubus parviflorus, var. parvifolius.

8. Var. **parvifolius** (Gray), comb. nov. (Plate 365, figs. 1–3). *R. nutkanas*, var. *parvifolius* Gray, Pl. Fendl., Mem. Amer. Acad. ser. 2, iv. 42 (1849).—Utah and New Mexico to northern Chihuahua. Utah: City Creek Canon, June 4, 1883, *F. E. Leonard.* New Mexico: shady banks of Santa Fé Creek, June, July, 1847, *Fendler*, no. 208 (type); Winsor's Ranch, alt. 8400 feet, Pecos River National Forest, *Standley*, no. 4032; 10 miles east of Mogollon, at 8700 feet, Mogollon Mts., Catron Co., *C. B. Wolf*, no. 2711; Mogollon Creek, at 7500 feet, Socorro Co., *Metcalf*, no. 281. Arizona: in timber, Thompson Ranch, Black River, *Goodding*, no. 576. Mexico: mountains 15–20 miles south of Pacheco, Chihuahua, *C. V. Hartman*, no. 696. Map 22.

Chamaerhodos Nuttallii Pickering, var. **keweenawensis**, var. nov. (tab. 366, figs. 1 et 2), caulibus ramisque valde hispidis, pilis ad 1.5 mm. longis.—Keweenaw County, Michigan: wind-swept crests, crevices and talus of sandstone-conglomerate, West Bluff, July 4, 1934, *Fernald & Pease*, no. 3376 (type in Gray Herb.). See p. 213 and map 10.

Chamaerhodos Nuttallii Pickering in Torr. & Gray, Fl. N. Am. i. 433 (1840), as synonym of *C. erecta* β. *Nuttallii* T. & G., l. c. (1840), Rydberg, N. Am. Fl. xxii. 377 (1908), validating the name, was based on *Sibbaldia erecta* β. *parviflora* Nutt. Gen. N. Am. Pl. i. 207 (1818), from "the highest gravelly hills, 10 to 15 miles from the Mandan villages." *C. Nuttallii*, found on arid plains and crests from Yukon to Colorado, east to Manitoba and western Minnesota, has the stem and branches densely glandular and at most minutely pilose. Its pubescence is well displayed in fig. 3, made from plants collected in the type region, dry hilltop, Mandan, North Dakota, June 23, 1912 by *O. A. Stevens*. The plant of the Keweenaw region, isolated by 375 miles from typical *C. Nuttallii*, is consistently hispid (as well as glandular) as shown in FIG. 2.

WALDSTEINIA FRAGARIOIDES (Michx.) Tratt., var. **parviflora** (Small), comb. nov. *W. parviflora*, Small, Bull. Torr. Bot. Cl. xxv. 137 (1898).

Waldsteinia fragarioides, like *Fragaria virginiana*, has petals highly variable in size as well as outline. When Small published *W. parviflora* as a new southern species he stated that "The new species may be distinguished from *W. fragarioides* by the more prominent disc, the small sessile petals which are about as long as the calyx-segments or shorter, and the larger obovoid achene." Later Rydberg, in N. Am. Fl. xxii[5]. 398 (1913), reduced *W. parviflora* to *W. Doniana* Tratt., the latter based on the description and plate of a plant introduced into English gardens by George Don and illustrated as *Dalibarda fragarioides* in Bot. Mag. xxxviii. t. 1567 (1813); and in his Manual Small accepts this reduction, stating his conception of the differences between *W. fragarioides* and *W. Doniana* as follows:

Petals twice as long as the sepals or longer; sepals mostly longer than the hypanthium....................1. *W. fragarioides*.
Petals as long as the sepals or shorter; sepals mostly shorter than the hypanthium..........................2. *W. Doniana*.

There is no evident or stated difference in the foliage and both plants show the same range of pubescence. If the distinction in the calyx given in Small's key is compared with the original plate of *W. Doniana* an unfortunate contradiction will be noted: the original plate of *W. Doniana* shows the hypanthia 3–4 mm. long, the lanceolate sepals 6.5–10 mm. long. In fact, *W. Doniana* is one of the extremes of *W. fragarioides* with longest rather than shortest sepals. In having the petals shorter than the exaggeratedly long sepals it differs from the more general run of *W. fragarioides* in the North, but its petals, correctly described "oblong-ovate," are shown in the plate up to 7 mm. long and 3.5 mm. broad, a measurement near the average for the northern plant. *W. parviflora*, under the misleading alias, *W. Doniana*, is defined as having "sepals triangular-lanceolate, . . . 2.5–3 mm. long" (*Rydberg*), "petals 2–4 mm. long" (*Small*).

I am, therefore, unable to see that *Waldsteinia Doniana* is quite identical with *W. parviflora*. It seems to me a garden-development in which, presumably through unwonted nutrition, the sepals became exaggeratedly large, the petals remaining fairly typical for *W. fragari-*

oides. In the northern half of the range of *W. fragarioides* (New England to Ontario and Wisconsin) I get the following measurements

Locality	Length of Hypanthium	Length of Sepal	Length of Petal	Breadth of Petal
1. Monmouth, Maine	3 mm.	5 mm.	8 mm.	3.2 mm.
2. Benton, Maine	2.5	3.5	6	4
3. Hanover, New Hampshire	2	4.5	6	3.7
4. Lebanon, New Hampshire	2	4.5	7	3.5
5. St. Johnsbury, Vermont	2	2.5	5	2.5
6. Brandon, Vermont	2.5	5.5	9.5	5
7. Charlotte, Vermont	3	5.5	6	4.5
8. Middlebury, Vermont	2	4.5	7	4.5
9. Fair Haven, Vermont	3.5	5	6	3
10. Sudbury, Vermont	2	2.3–3	3.5	3
11. Poultney, Vermont	2	2.7	4.5	3
12. Brandon, Vermont	3.5	5.5	10	5
13. Coleraine, Massachusetts	3	3.5	8.5	6
14. Greenfield, Massachusetts	2.3	4	7	3.2
15. Greenfield, Massachusetts	4	6.5	10	5
16. Pittsfield, Massachusetts	2	4	7.5	4
17. Elmira, New York	2.5	5	5.5	3
18. Canadice, New York	2.5	5.5	8	3
19. Bainbridge, New York	3	4	6	5
20. Vaughns, New York	3	7.5	10	5.5
21. Newcomb, New York	2	3.8	4	2.8
22. Wingham, Ontario	3	2.7	6	2
23. Brittania, Ontario	2.5	4	6	3
24. Kingston, Ontario	3	5	6	3.5
25. Depere, Wisconsin	2.5	3.5	5	3.3
26. Lake Owen, Wisconsin	2	4	5.5	3

In the southern half of the range, down the Alleghanies, the measurements are similarly variable; but in the mountains from Virginia to Tennessee and Georgia there occurs an extreme plant with tiny petals, *Walsteinia parviflora* Small. There are only three sheets of it in the Gray Herbarium, but the measurements, while in most points overlapping those of the more northern *W. fragarioides*, indicate a fairly marked geographic variety, with very narrow and short petals:

Locality	Length of Hypanthium	Length of Sepal	Length of Petal	Breadth of Petal
Mts. North Carolina	2.5–3.5	3–4	3.5–4	1.5
Harriman, Tennessee	2–2.5	3–3.5	3.5	1.5
Northern Georgia	2.5	3–4.5	2.5	1

Potentilla pensylvanica L. Ontario: sandy plain, Espanola, Sudbury Distr., no. 3378; sandy ground, site of Hudson Bay Co. post, Agawa Bay, Algoma Distr., *Pease*, no. 17,965. Michigan: Isle Royale, July 21, 1909, *Cooper;* wind-swept crests, crevices and talus of sandstone-conglomerate, West Bluff, no. 3379.

This is the plant treated by Rydberg as *Potentilla pensylvanica* L. Rydberg, in 1898, gave the range: "a comparatively rare plant, ranging in British America from Hudson Bay to the Rockies, and in these extends southward to Colorado";[1] in 1908 he gave a similar range for his *P. pensylvanica:* "On the plains from Hudson Bay to the Yukon Territory and Colorado."[2] This species has the radical leaves definitely "pinnate with 7–15 leaflets, . . . leaflets gradually reduced downward, . . . divided . . . into oblong divisions" (*Rydberg*) and its easternmost known stations are on the west side of Hudson Bay and near the shores of Lakes Superior and Huron.

There has been much uncertainty regarding the exact typification of *Potentilla pensylvanica.* The Linnean account was as follows:

> *pensyluanica* 28. POTENTILLA foliis inf[e]rioribus pinnatis, superioribus ternatis: foliolis inciso-serratis, caule erecto pubescente.
> Pentaphylloides canadense, foliis agrimoniae. *Boerh. lugdb. I. p. 40.*
> *Habitat* in Canada. ♃.
> Folia Radicalia *pinnata: foliolis oblongis, obtusiusculis, serrato-dentatis, lineatis, mollibus, villosis: extimis tribus coadunatis maioribus; int[f]erioribus minoribus alternis.* Caulina *subdigitata, septena, ut P. recta, sed pinnatifida.* Petala *vix calyce maiora.* Habitus *P. rectae.* H. U. [Hortus Upsaliensis].[3]

From the habitat "Canada" and from the citation of Boerhaave's plant, which he had received through Sarrasin, who was physician of the Court of Quebec, it is natural to infer that the name *P. pensylvanica* belongs to the plant of coastal rocks and gravels which abounds on the lower St. Lawrence, thence northeastward through the Straits of Belle Isle and southward to the coast of New Hampshire. In 1896, Rydberg described the latter as *P. litoralis* Bull. Torr. Bot. Cl. xxiii. 264 (1896), characterized by "Leaves pinnate, of two approximate pairs of leaflets, the lower the smaller, or subdigitately 5-foliolate." Slightly thereafter, in his *Monograph* (1898) Rydberg maintained the plant of the eastern coast as *P. litoralis,* the plant of the Great Plains as *P. pensylvanica;* but he threw doubt into the situation by saying in his discussion of the western "*P. pensylvanica*": "There is some doubt as to whether this is the true *P. Pennsylvanica* L. The description of the leaves of that species seems to indicate rather *P. litoralis*" (p. 96). Under the treatment of the latter he correctly summarized the difference in the range of the two: "*P. litoralis* is principally a beach plant, or at least growing near the coast, while *P. Pennsylvanica*

[1] Rydb. Mon. N. A. Potent., Mem. Dept. Bot. Columb. Univ. ii. 97 (1898).
[2] Rydb. N. Am. Fl. xxii. 350 (1908).
[3] L. Mant. 76 (1767).

is an inland, plain or mountain species." *P. litoralis* was well illustrated in Rydb. Mem. Dept. Bot. Columbia Univ. ii. t. 37, figs. 1–5.

Subsequently (1908), without repeating the doubt he had expressed in 1898, Rydberg maintained the inland species with elongate, pinnate leaves of 7–11 leaflets as *P. pensylvanica,* the eastern coastal plant as *P. pectinata* Raf. Aut. Bot. 164 (1840). Rafinesque's account was unusually good:

> 1204, *Pot. pectinata* Raf. Pensylv. L. Tor[rey]. rare sp. of Canada and Boreal America, not of Pennsylvania: leaves hardly pinnatiform, rather digitate, 3–7folioles cuneate narrow pectinate, stipules lanceol. 2–3parted, stem bifurcate, calix linear lanceol. hirsute.

Potentilla pectinata Raf. (1840) and *P. litoralis* Rydb. (1896) are, then, synonyms, both belonging to the eastern coastal species. In view, however, of the facts, that Canada of Linnean time was primarily Quebec, that the Sarrasin specimen, which Boerhaave had, presumably came from the shores of the lower St. Lawrence, and that Rydberg had, himself, doubted in 1898 whether the eastern, rather than the western plant should stand as *P. pensylvanica,* it has seemed wise to settle the question. Through the always accommodating Assistant Secretary of the Linnean Society of London, Mr. S. Savage, I have a photograph of the Linnean type. Mr. Savage's letter accompanying it states that

> I now send you a photograph of the type specimen of *Potentilla pensylvanica* Herb. Linn. The inscriptions on this sheet are as follows:
> *Ard* [= Arduino], in Linnaeus's hand.
> *pensylvanica,* in Linnaeus's hand.
> Label in bottom right hand corner,—*13* in Arduino's hand, and *pensylvanica* in Linnaeus's hand.

The specimen which Linnaeus had before him and described in detail, even to the 7 lobes of the upper leaflets of the cauline leaves, is clearly the type; it is the specimen of which Torrey wrote in 1824: "*Sir J. E. Smith* informs me, that *P. pennsylvanica* of the Linnean Herbarium resembles *P. recta* in shape of leaflets and serratures, but is pinnate and very soft-downy."[1]

That it is a phase of the inland plant there can be no question; and that the name *pensylvanica* is quite as inappropriate for it as it would be for the Canadian and New England *P. pectinata* is equally obvious. In explanation of the misleading specific name published by Linnaeus a second letter from Mr. Savage is illuminating. Following up the source of *P. pensylvanica,* he finds that Linnaeus received it from

[1] Torr. Fl. N. Mid. U. S. 499 (1824).

Arduino some time subsequent to the publication of Species Plantarum ed. 2 (1762-63), and that the manuscript list of the specimens received at that time has in Linnaeus's hand the entry:

13. PENTAPHYLLOID. CANADENSE. *Potentilla canadensis* non habeo in speciebus accepi nuper ab aliis pulcherrimum specimen.

Since Linnaeus had already published the quite different *Potentilla canadensis* Sp. Pl. i. 498 (1753), it is evident that he adopted for the plant received from Arduino and published as *P. pensylvanica* (1767) a substitute-name which he thought to be equally appropriate.

With the type of *Potentilla pensylvanica* now settled, it becomes necessary to decide to what American species it belongs. I am unable, in the first place, to maintain as distinct species the plants kept up in the North American Flora as *P. pensylvanica* and *P. strigosa.* Others of the segregates seem to me conspecific but these, being later published, need not now concern us. The range of *P. pensylvanica,* as stated by Rydberg, has already been given. That of *P. strigosa* is amazingly similar, except for the inclusion of Asia: "Plains from Hudson Bay to Kansas, New Mexcio, and British Columbia; also northern Asia, according to Lehmann."

Rydberg's *Potentilla pensylvanica* is keyed by him (N. Am. Fl.) under "Petioles and stem appressed-pubescent" and the fuller diagnosis says "stem . . . more or less appressed-pubescent and tomentulose" while in the parallel definitions (key and diagnosis) *P. strigosa* is under "Petioles and stem with spreading hairs" and "stems . . . with long spreading hairs." Pubescence of "long spreading hairs" is not what one would expect of a plant called *strigosa,* for *striga* was originally a swath of mowed hay or grain (lying flat) and in modern scientific terminology *strigae* are defined as "sharp close-pressed rigid hairs" (*Lindley,* Treas. Bot.), and the adjective strigose (*strigosus*) as "covered with strigae" (*Lindley*), "beset with *appressed* sharp straight and stiff hairs" (*Gray*) or "beset with sharp-pointed *appressed* straight and stiff hairs or bristles" (*Jackson*) [Italics mine].

In 1898, when he treated *Potentilla strigosa* as a variety of *P. pensylvanica,* Rydberg regarded "typical *P. Pennsylvanica* . . . a comparatively rare plant," while *P. pensylvanica,* var. *strigosa* was "the most common form of *P. Pennsylvanica,* found in the same range as the species." That the two are separated only by illusory differences is clearly indicated by some of the plates specially selected by Rydberg as illustrating them. The first synonym under Rydberg's *P. pensylvanica* (N. Am. Fl. p. 350) is *P. missourica* Hornem. in Lindl.

Bot. Reg. xvii. t. 1412 (1831). The plate is one of Hart's characteristic drawings and it is significant that the horizontally spreading or even slightly reflexed stiff hairs are shown uniformly on the stem, petiole and rachis. As an illustration of Rydberg's *P. pensylvanica* with "Petioles and stem appressed-pubescent" it is very contradictory; as an illustration of his *P. strigosa* with "Petioles and stem with spreading hairs" it would be thoroughly characteristic. The hairs shown on the plate of the type of *P. missourica* are positively divergent; those shown in the plate (Mem. Dept. Bot. Columbia Univ. ii. t. 38, fig. 2) selected to illustrate the plant "with spreading hairs" are not strongly spreading. The futility of trying to maintain two species, "found in the same range" and with no stronger difference than that emphasized in the North American Flora is apparent.

Returning to the question of what *Potentilla strigosa* really is, it becomes necessary to review the somewhat inconclusive history of the name. Pallas, the great explorer and early writer on the flora of Siberia, left an Asiatic specimen marked *Potentilla strigosa.* Pursh, taking up *P. pensylvanica* for the plant of "Canada and New England" (i. e. *P. pectinata*), found the specimen of the undefined *P. strigosa* Pallas in Lambert's herbarium, and taking it to be a variety of the plant of the eastern American coast, called it *P. pensylvanica,*

strigosa. β. P. cano-pubescens; foliis pectinato-dentatis margine revolutis, floribus corymbosis.
P. strigosa. *Pallas in Herb. Lambert.*
Icon. *Gmel. sib. 3. t. 34. f.* 1.
. . . . .β. on the Missouri. . . . .
. . . .*β. v. s. in Herb. Lewis*. . . . .
. . . . .The variety β. appears to be a distinct species.[1]

The plant of the Missouri, collected by Capt. Lewis and described by Pursh "cano-pubescens" (not necessarily "with long spreading hairs") was supposed by Pursh to be the undescribed *P. strigosa* Pallas of Asia and the varietal name *P. pensylvanica,* β. *strigosa* Pursh consequently rests, at least in intent, partly upon the Siberian plant, which will now be checked. Pursh also cited a plate of a Siberian plant, one of Gmelin's very crude drawings which is not clearly referable by citation to any species discussed in Gmelin's text nor to anything North American. Regarding Gmelin's plate Trattinnick specially commented: "Quoad iconem Gmelini et notas a Purshio tributas non potest esse eadem cum P. pensylvanica."[2] That element

[1] Pursh, Fl. Am. Sept. 356 (1814).
[2] Tratt. Rosac. Mon. iv. 31 (1824).

Photo. E. C. Ogden.

Potentilla fruticosa, forma villosissima: fig. 1, fruiting branch, × 1; fig. 2, leafy branch, × 1; fig. 3, branchlet, × 3.

TYPE OF GEUM VIRGINIANUM
(Specimen in Linnean Herbarium; photograph from Mr. *S. Savage*).

of Pursh's concept may be dismissed as having nothing to do with the plant of the Missouri which Pursh specially described.

The Pallas plant, *P. strigosa*, was formally recognized as a species (and thus validated) by Trattinnick in 1824. Trattinnick's treatment follows:

POTENTILLA *strigòsa. Pallas.*

P. cano-pubescens; foliis pectinato-dentatis, margine revolutis, floribus corymbosis. Pursh.
Potentilla strigosa. Pall. in herb. Lambert.
Potentilla pensylvanica β. strigosa. Pursh. fl. Amer. sept. ed. 2. I. 356. Lehm. Potent. p. 55. Poir. Encycl. Suppl. IV. 543.
Potentilla foliis duplicato-pinnatis, venatis, valde exstantibus, subtus albicantibus, caule corymboso. Gmel. fl. sibir. III. p. 181. t. 34. f. 1.
Hab. in Sibiria, nec non ad Missurim fluvium in provincia Luisiana Amer. sept.

This account by Trattinnick, followed by the statement above quoted, that Gmelin's plate 34, fig. 1 does not belong to *Potentilla pensylvanica*, validly launched *P. strigosa* as a specific name. It is evident, however, that it was still as confused in the mind of Trattinnick as it had been with Pursh, but that Trattinnick made *P. strigosa* primarily Siberian. Many sheets of Asiatic plants distributed as *P. pensylvanica* or as *P. strigosa* are in the Gray Herbarium. About one half of those called *P. pensylvanica* are *P. chinensis* Seringe, the other half *P. niponica* Wolf; while the five sheets from the Altai sent out by Bunge and by Fischer as *P. strigosa* are quite unlike anything on our western plains.

If *Potentilla strigosa* Pallas is to be interpreted as the Siberian plant which Pallas had, then the name cannot be used for a wholly different North American species. If *P. strigosa* Pallas, first validly published as a species by Trattinnick in 1824, rests upon *P. pensylvanica* β. *strigosa* Pursh, of North America, it must not be overlooked that Pursh intentionally took the name from Pallas. At best the concept was from the start a confused one; to maintain the name *P. strigosa* Pallas for a strictly North American species would completely misinterpret Pallas's intention.

Chronologically, the next-published specific name for the characteristic plant of the Great Plains, which, it would seem, has been erroneously passing as *P. strigosa*, is *P. missourica* Hornem. in Lindl. Bot. Reg. xvii. t. 1412 (1831). This, although based on a very luxuriant garden specimen, is without question our plant. The name given by Horneman, without explanation, suggests that he was using it, correctly, because his species was that brought back by Capt.

Lewis from the Missouri and described by Pursh as *P. pensylvanica*, β. *strigosa*. The name *P. missourica* is unequivocal; and by those who see a specific line separating it from *P. pensylvanica* it should be used for the plant which Rydberg maintained as *P. strigosa*. As sufficiently emphasized, I can find no such line of cleavage.

Potentilla fruticosa L., forma **villosissima**, f. nov. (tab. 367), ramulis stipulis foliis utrinque dense albido-villosis, villis subsericiis; caulibus adscendentibus 3–6 dm. altis; foliis plerumque 5-foliolatis, foliolis ad 1.5 cm. longis.—Ontario: limestone pavement and gravel, Great Cloche Island, Manitoulin District, June 29, 1934, *Fernald & Pease*, no. 3382. (type in Gray Herb.).

I hesitate to add to the many described forms of the polymorphic *Potentilla fruticosa*, especially since these numerous variations over the Northern Hemisphere have not been properly systematized. I can find none of the described variations, however, to which the extremely white-villous form of Great Cloche Island can be referred. That it is an ecological form rather than a geographically segregated variety is indicated by its passing very definitely on Great Cloche Island into the less villous or greenish-leaved shrub in the less xerophytic situations. Plate 367 shows typical branches, with an enlarged portion (fig. 2) to illustrate the dense villosity.

P. simplex Michx. See Fern., Rhodora, xxxiii. 188, t. 215, fig. 1 (1931). Ontario: dry ledges along the river, Massey, no. 3383.

Known range in Ontario extended north from shores of Lakes Ontario and Erie.

Geum laciniatum Murr. Comm. Novi. Gott. v. 30, t. 2 (1774); F. Bolle in Fedde, Repert. Beih. lxxii. 55 (1933). *G. virginianum*, var. *Murrayanum* Fern. Rhodora, xxv. 99 (1923).

Bolle, l. c. 71, points out that *Geum virginianum* L. was based on the very distinct southern species which has been known as *G. flavum* (Porter) Bicknell, Bull. Torr. Bot. Cl. xxiii. 523 (1896), a species which has the geographic advantage of occurring in Virginia, whereas the species which has been erroneously passing as *G. virginianum* apparently reaches its southeastern limit in Pennsylvania. In describing *G. virginianum* Linnaeus cited references from his earlier *Hortus Cliffortianus* and from Gronovius and Hermann, and, most fortunately, gave a new diagnosis based upon the material before him. The only specimen in the Linnean Herbarium definitely marked by Linnaeus "H. U. [Hortus Upsaliensis] *virginianum*," the specimen which must stand as the type, is shown in plate 368, made from a photograph supplied by Mr. S. Savage, Assistant Secretary of the

Linnean Society of London. A second sheet, quite different from the first but pinned to it, was not marked by Linnaeus and, therefore, is not specially significant. The only plate cited by Linnaeus under *G. virginianum* (Hermann, Paradisus Batavus, t. 25), although much conventionalized, is not at all inconsistent with the type specimen, either in its characteristic foliage or in its elongate and lax branching. Gronovius gave no original diagnosis, merely copying that of Linnaeus in *Hortus Cliffortianus* and also the reference to Hermann which was also given by Linnaeus.

Since *Geum virginianum* proves to be quite distinct from the coarser and hirsute plant of broader continental range which we have been calling "G. virginianum," we must seek a name for the latter. The earliest name available seems to be G. LACINIATUM Murr., taken up by Bolle. Murray's plant, upon which I based *G. virginianum*, var. *Murrayanum*, has quite glabrous carpels and is generally of more northern range than the bristly-fruited plant which, in 1923, I mistook for typical *G. virginianum*. The latter should be called

G. LACINIATUM Murr., var. **trichocarpum**, var. nov., carpellis supra setosis.—TYPE: swampy woods, Franklin, Connecticut, August 22, 1914, *R. W. Woodward* in Gray Herb.

The variety occurs from Nova Scotia to Ontario (swale at base of gneiss hill, Markstay, Sudbury Distr., no. 3386), south to Pennsylvania and Missouri.

The common North American plant which with us is passing as *Geum strictum* Ait. Hort. Kew. i. 217 (1789) is so nearly identical with the Eurasian *G. aleppicum* Jacq. Ic. Pl. Rar. i. t. 93 (1781–1786) and Coll. i. 88 (1786) that the two, along with some others which often pass as local species, apparently represent one circumboreal and variable specific type. In Europe, recent authors (Ascherson & Graebner, Domin, Bolle) have been reducing the North American (and eastern Asiatic) *G. strictum* Ait. without qualification to *G. aleppicum*. Dr. Eric Hultén, however, maintains *G. strictum* tentatively, saying "The picture given by JACQUIN [our PLATE 369] shows a plant with radical leaves having large rounded slightly lobated terminal leaflet, and several European specimens of the corresponding plant also have similar large basal leaves. Our plant [*G. strictum*] usually has a three-cleft acutely serrated terminal leaflet on the radical leaves, but sometimes leaves occur resembling that illustrated by JACQUIN. They are then small and wither early. As our plant is apparently not quite identical with the European, I prefer to name it as above, which is in any case correct. The difference between the two plants is certainly not great and after a close study of a large amount of material from Europe, Asia and America it may perhaps prove most rational to unite them under the older name *G. Aleppicum.*"[1]

The difference in basal leaves brought out by Hultén is a character of rather negative value. As he says, typical *Geum aleppicum* (PLATE 369) has the basal leaves with large rounded terminal leaflet, while *G. strictum* often lacks this rounded terminal leaflet but usually has some or all of the radical leaves with more acutely and deeply dissected terminal leaflet. In the large series of North American material before me this character is highly variable. Of the sheets which properly display the radical leaves 75 lack the broad and rounded type which characterizes typical *G. aleppicum* of Eurasia, but 82 have such leaves, some specimens quite lacking the more dissected basal foliage. An average, small North American plant, × 2/5, is shown in PLATE 370, FIG. 1.

After studying typical *Geum aleppicum* from various stations in Armenia, Slovakia, Galicia and Prussia I find one difference which seems to separate true *G. aleppicum* from *G. strictum.* In the former the body of the achene (FIGS. 2 and 3) is long-villous, in the latter (FIGS. 4 and 5) it is smooth except on the margin and summit or only short-pilose. Although the two are apparently conspecific it will make for clarity to recognize the wide-ranging North American and eastern Asiatic plant as

G. ALEPPICUM, var. **strictum** (Ait.), comb. nov. *G. strictum* Ait. Hort. Kew. ii. 217 (1789), as to North American plant described, but excluding synonym *G. aleppicum.* PLATE 370, FIGS. 1, 4 and 5.

PLATE 370 shows a characteristic small plant of *Geum aleppicum,* var. *strictum* (FIG. 1) from Vermont (*E. F. Williams*). FIG. 2 shows a fruiting head, × 2, of typical *G. aleppicum* from Slovakia (*Domin & Krajina,* Fl. Čechoslov. Exsicc., no. 272); FIG. 3, a typical achene, × 10, of *G. aleppicum* from Prussia (*C. Sania*). FIG. 4 is a typical fruiting head, × 2, of var. *strictum* from New Hampshire; FIG. 5 a mature achene, × 10, from New Hampshire.

G. MACROPHYLLUM Willd. MICHIGAN: near Sault Ste. Marie, August 14, 1910, *J. R. Churchill* in Gray Herb.

In his map of the North American range of *Geum macrophyllum,* RHODORA, xxxiii. 175 (1931), Dr. H. M. Raup indicated the occurrence

[1] Hultén, Fl. Kamtch. iii. 77 (1929).

GEUM ALEPPICUM
(after *Jacquin*).

Photo. E. C. Ogden.

GEUM ALEPPICUM: FIG. 2, portion of fruiting head, showing villous achenes, × 4, from Slovakia; FIG. 3, achene, × 10, from East Prussia.

G. ALEPPICUM, var. STRICTUM: FIG. 1, small fruiting plant, × 1, from Vermont; FIG. 4, portion of fruiting head, showing sparsely pubescent achenes, × 4, from Nova Scotia; FIG. 5, achene, × 10, from New Hampshire.

of the species on the Lower Peninsula. Judge Churchill's material is quite typical of *G. macrophyllum*.

G. MACROPHYLLUM, var. PERINCISUM (Rydb.) Raup, RHODORA, xxxiii. 176 (1931). *G. perincisum* Rydb. N. Am. Fl. xxii. 405 (1913). MICHIGAN: in slashings, Turin, Marquette Co., June 24, 1901, *Bronson Barlow* in Gray Herb.

Rydberg included Michigan in his statement of range, and Raup has a dot on the Upper Peninsula, as the extreme eastern limit on his map. The Barlow specimen is here cited that the record may be more definitely localized; the Barlow plant is of the most extreme development of the variety, having both basal and cauline leaves sharply incised.

G. TRIFLORUM Pursh. ONTARIO: savannahs, swales and peaty depressions in the limestone pavement, Great Cloche Island, no. 3387.

Macoun's records and all specimens in the Canadian National Herbarium and the herbarium of the University of Toronto are from southern Ontario.

DRYAS DRUMMONDII Richardson. ONTARIO: on dry cliffs, south side of North Slate Island, Thunder Bay District, *Pease & Bean*, no. 23,629.

The Slate Islands are the only known locality for this characteristic species between the Rocky Mountains and the Gaspé Peninsula (see p. 197). Already reported by Macoun as collected there by Prof. Ellis. The Pease & Bean collection consists of a single typical specimen.

GERANIUM CAROLINIANUM AND ALLIES OF NORTHEASTERN NORTH AMERICA (PLATES 371–374).—In the limestone gravel of Great Cloche Island we collected a plant, there abundant, which looked so unlike either *Geranium carolinianum* or *G. Bicknellii*, the two native small-flowered species conventionally recognized in the general area, that its identification has led to a somewhat extended study of the small-flowered Geraniums occurring in northeastern North America. This study has brought to light some reliable diagnostic characters not heretofore emphasized and it has shown that some of our plants have been passing under erroneous or quite unnecessary names. I am, therefore, here presenting a key to the species involved, with fuller discussion of some of the more critical plants. My grouping of the members of true *Geranium* (excluding *G. Robertianum* from the present discussion) is as follows.

a. Petals 1.4–2.3 cm. long, 0.7–1.3 cm. broad, much exceeding calyx; terminal beak of mature style-column 5–10 mm. long; anthers 2–3 mm. long; perennials with thick crowns and stout rhizomes (*G. maculatum* L., *G. pratense* L. and the casual garden-escapes, *G. ibericum* Cav. and *G. sanguineum* L.).

a. Petals smaller, shorter than to exceeding calyx; beak of mature style-column 0–6 mm. long; anthers 0.5–0.8 mm. long; annuals or biennials (nos. 1 and 7 perennial) with tap-roots.....*b.*

b. Sepals prominently awned or subulate-tipped, the tips 0.7–3 mm. long; seeds with reticulate surfaces....*c.*

c. Peduncles all 1-flowered or terminated by 1 pedicel...1. *G. sibiricum*

c. Peduncles all or nearly all with 2 pedicels; inflorescences 2–∞-flowered....*d.*

d. Fruiting pedicels much longer than calyx; beak of mature style-column 2.5–6 mm. long.

Pedicels with minute appressed glandless pubescence; carpel-bodies glabrous..............2. *G. columbinum.*

Pedicels densely glandular-pilose; carpel-bodies hairy....................................3. *G. Bicknellii.*

d. Fruiting pedicels shorter than to slightly longer than calyx; beak of mature style-column 1–2 mm. long....*e.*

e. Carpel-bodies short-hirsute with horizontally spreading hairs; lobes of middle and upper leaves acute; seed strongly reticulate or pitted, with subuniform square or rounded unequally thick-walled pits .4. *G. dissectum.*

e. Carpel-bodies long-villous with ascending hairs; leaf-lobes obtuse; seeds loosely reticulate with irregular elongate thin-walled areolae or obscurely and subuniformly reticulate.

Larger mature sepals broadly ovate, 5–8 mm. wide, 5-nerved; seed subspherical, 2–2.7 mm. in diameter, faintly reticulate with about 50 rows of small square to rounded areolae.......5. *G. sphaerospermum.*

Larger mature sepals 3–4.5 mm. wide, 3-nerved; seeds oblong, 1–1.5 mm. thick, with 20–35 irregular rows of loosely elongate areolae..6. *G. carolinianum.*

b. Sepals awnless, at most with minute callous tips; seeds smooth or only minutely granular....*f.*

f. Carpel-bodies not cross-wrinkled, finely pubescent; style-column beakless.

Sepals 5–8 mm. long; petals twice as long, deeply notched; carpel-bodies 3–3.5 mm. long, puberulent; fruiting style-column 1.1–1.5 cm. long........7. *G. pyrenaicum.*

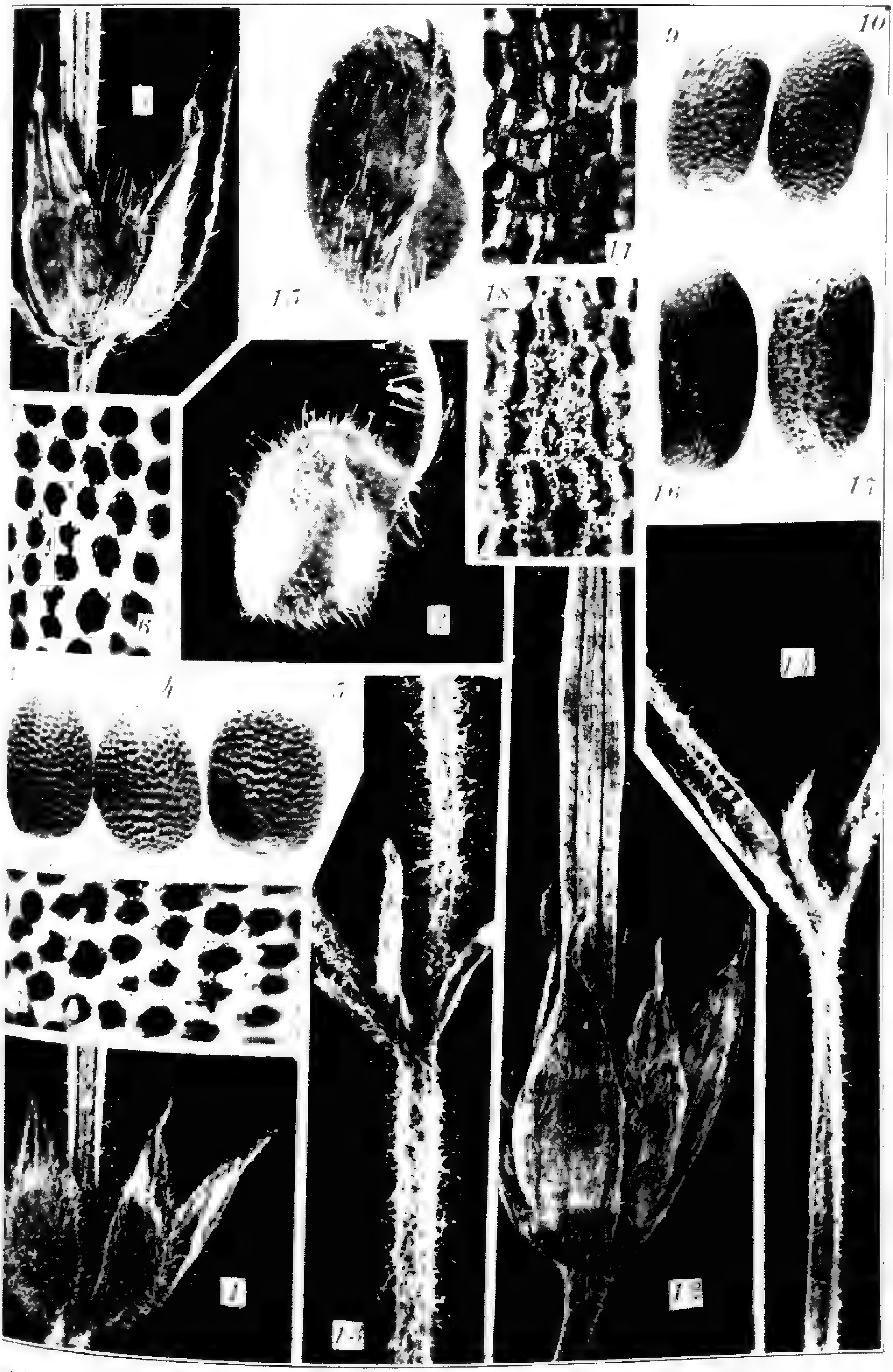
Sepals 2.5–4 mm. long; petals about as long, shallowly notched; carpel-bodies 2 mm. long, strigose; fruiting style-column 6–9 mm. long..................8. *G. pusillum.*

f. Carpel-bodies conspicuously cross-wrinkled, glabrous; style-column terminated by a filiform beak 1–2 mm. long..9. *G. molle.*

1. G. sibiricum L. Sp. Pl. i. 683 (1753).—Locally naturalized from Eurasia: New York and Pennsylvania to Illinois.

2. G. columbinum L. Sp. Pl. i. 682 (1753).—Locally naturalized from Europe: New York and Ohio, south to Virginia and West Virginia; South Dakota.

3. G. Bicknellii Britton. Hairs of upper internodes unequal, some long, others short and sometimes gland-tipped; peduncles and pedicels loosely hirsute and with shorter often glandular hairs inter-



E. C. Ogden.

[G]ERANIUM DISSECTUM: FIG. 1, calyx, × 5, of *G. laxum;* FIG. 2, carpel-body, × 5; FIG. 3, [se]ed, × 10, from Ireland; FIG. 4, seed, × 10, from Oregon (*G. laxum*); FIG. 5, seed, × 10, [fro]m North Carolina; FIG. 6, surface of seed, × 50, from Ireland; FIG. 7, surface of seed, [×] 50, of *G. laxum.*

G. BICKNELLII: FIG. 8, calyx, × 5; FIGS. 9 and 10, seeds, × 10; FIG. 11, surface of seed, × 50.

G. BICKNELLII, var. LONGIPES: FIG. 12, calyx, × 5; FIG. 13, peduncle and pedicel, × 10, [fro]m TYPE; FIG. 14, peduncle and pedicel, × 10, from ISOTYPE of *G. nemorale;* FIG. 15, [car]pel-body, × 5; FIG. 16, seed, × 10; FIG. 17, seed, × 10; FIG. 18, surface of seed, × 50.

Photo. E. C. Ogden.

GERANIUM SPHAEROSPERMUM: FIG. 1, portion of fruiting plant (TYPE), × 1; FIG. 2, calyx, × 5; FIG. 3, carpel-body, × 10; FIG. 4, seed, × 10; FIG. 5, surface of seed, × 50. G. TEXANUM: FIG. 6, calyx, × 5; FIG. 7, carpel-body, × 10; FIGS. 8 and 9, seeds, × 10; FIG. 10, surface of seed, × 50.

mixed; calyx unequally ciliate-hirsute on margin and nerves.—Bull. Torr. Bot. Cl. xxiv. 92 (1897).—Open woods, clearings and disturbed soil, Newfoundland to Alberta, south to Nova Scotia, Massachusetts, western Connecticut, New York, northern Indiana and Iowa. PLATE 371, FIGS. 8–11.

Var. **longipes** (Wats.), comb. nov. Pubescence of upper internodes, peduncles and pedicels more uniform, short and gland-tipped; sepals with shorter gland-tipped ciliation; seeds slightly larger. *G. carolinianum*, var. *longipes* Wats. Bot. King's Expl. 50 (1871). *G. nemorale* Suksd. Deuts. Bot. Monats. xvi. 222 (1892). *G. longipes* (Wats.) Goodding, Bot. Gaz. xxxvii. 56 (1904).—Western Ontario, northern Michigan and Minnesota; Saskatchewan to British Columbia, south to Colorado, Utah and northern California. PLATE 371, FIGS. 12–18.

The western material of *Geranium Bicknellii* seems to be mostly a consistent series, characterized by the comparatively short and nearly uniform mostly glandular pubescence of the upper half of the plant. About the Great Lakes both extremes and numerous transitions occur and I can find no essential differences (except a slight one of size) of seeds between the typical eastern *G. Bicknellii* (FIGS. 9–11) and typical western var. *longipes* (FIGS. 16–18), although there are individual variations in the walls of the alveolae. Though Hanks and Small, N. Am. Fl. xxv. 4–10 (1907) reduce *G. carolinianum* var. *longipes* and the resultant *G. longipes* without question to eastern *G. Bicknellii*, they maintain *G. nemorale* as a distinct species, *G. Bicknellii* described with "peduncles glandular-villous," *G. nemorale* separated by "peduncles retrorsely pubescent." A portion of a peduncle from the TYPE (*Watson*, no. 206) of *G. carolinianum* var. *longipes* is shown in FIG. 13, × 10, one from an ISOTYPE (*Suksdorf*, no. 2028) of *G. nemorale* in FIG. 14, also × 10; I see no specific nor other characters to separate them.

4. G. DISSECTUM L. Cent. Pl. i. 21 (1755). *G. laxum* Hanks in N. Am. Fl. xxv. 9 (1907).—Somewhat adventive in the Eastern States; generally naturalized from Europe on the Pacific slope. PLATE 371, FIGS. 1–7.

Although the common plant of the Pacific slope has generally been recognized as an early and rapidly spreading introduction from Europe, Hanks & Small treat it as an endemic American species "resembling *G. dissectum.*" In their key *G. dissectum* is assigned "Seeds pitted" as contrasted with *G. laxum* with "Seeds reticulate"; *G. dissectum* with "carpel-bodies pubescent with minute spreading hairs," *G. laxum* with them "glandular-pubescent." In the fuller diagnoses, however, we find under *G. dissectum* "carpel-bodies 2–2.5 mm. long, glandular-pubescent," while *G. laxum* (which in the key had them "glandular-pubescent") in the diagnosis has "carpel-bodies 2–2.5 mm. long, hirsute." The difference is not clear, unless it is to be found in the "pitted" seed of *G. dissectum*, the "reticulate" seed of *G. laxum*. Dr. Gleason has most kindly lent me the type and a number of authentic sheets of *G. laxum*. They are of the characteristic western American introduced plant. Seeds from *G. laxum* of western North America, × 10, and their markings, × 50, are shown in PLATES 371, FIGS. 4 and 7, similar enlargements of seeds of European *G. dissectum* and of the weed introduced in eastern America are shown in FIGS. 3, 5 and 6. No essential difference is apparent.

5. G. **sphaerospermum** sp. nov. (TAB. 372, FIGS. 1–5). Annuum vel bienne, *G. carolinianum* simulans; caulibus simplicibus vel ramosis ramis adscendentibus, 1–4.5 dm. altis minute retrorseque albido-pilosis; foliis reniformi-orbiculatis 2–7 cm. latis profunde 5-partitis, segmentis apice lobatis lobis obtusis; inflorescentiis terminalibus confertis umbelliformi-corymbosis; pedunculis pedicellisque minute retrorso-pilosis valde abbreviatis; sepalis late ovatis manifeste mucronatis accrescentibus maturis 5–8 mm. latis 5-nerviis, nervis margineque piloso-hirsutis; petalis roseis sepalis subaequantibus; columnis stylorum maturorum 1–1.5 cm. longis piloso-hirsutis, apice rostratis, rostro subulato 1–1.5 mm. longo; valvulis longe villosis, villis adpresso-adscendentibus; seminibus subsphaericis 2–2.7 mm. diametro obsolete reticulatis, areolis ca. 50-seriatis quadratis vel rotundatis.—Limestone gravel and rich clearings, Ontario to Washington, south to northern New York, South Dakota, Montana and northern California. The following have been examined. ONTARIO: sur les calcaires du Lac Constance, South March, 4 juillet 1922, *Victorin*, no. 15,912; Whitby, August 13, 1915, *L. V. Baker* (herb. Univ. Toronto); savannahs, swales and peaty depressions in the limestone pavement, Great Cloche Island, June 29, 1934, *Fernald & Pease*, no. 3405 (TYPE in Gray Herb.). NEW YORK: rocky banks (calcareous), Black River below Watertown, June 27, 1922, *House*, no. 8925 in part (mixed with and distributed as *G. Bicknellii*). SOUTH DAKOTA: Whitewood, alt. 4500 ft., Black Hills, July 7, 1892, *Rydberg*, no. 585; near Old Fair Grounds, Limestone, Black Hills, July 6, 1909, *J. Murdoch, jr.*, no. 3532; moist ravines, Deadwood, July 19, 1913, *Carr*, no. 67. SASKATCHEWAN: wheat-field west of Yorktown, July 7, 1906, *Herriot* in Herb. Geol. Surv. Can., no. 70,864; Thomas Lake, August 19, 1906, *Herriot* in Herb. Geol. Surv. Can., no. 70,864. MONTANA: Seely Lake (near Knopp place), August 6, 1924, *Kirkwood*, no. 1837; Bozeman, September 5, 1901, *W. W. Jones*. WASHINGTON: Clark Springs, Spokane, July 10, 1902, *Kreager*, no. 132. CALIFORNIA: Berry Cañon, Butte Co., May 8, 1902, *Heller* (apparently belongs here, too young

for final identification). All, unless noted, distributed as *G. carolinianum.*

Geranium sphaerospermum is at once separated from *G. carolinianum* (PLATES 373 and 374) by its very broad and 5-nerved sepals, its essential lack of glandularity and by the entirely different seed, *G. carolinianum* having elongate seeds with a loose reticulation of elongate areolae (PLATE 374, FIGS. 3–5, 7 and 8). Whereas *G. carolinianum* is of broad range across the southern United States, barely reaching north into southernmost Canada and occurring in sterile, circumneutral to acid sands and gravels, *G. sphaerospermum* is a Canadian calcicolous species. At its type locality, on Great Cloche Island, it was associated with a notable and characteristic group of calcicoles: *Equisetum variegatum, Bromus Kalmii, Agropyron trachycaulum, Eleocharis compressa* and *pauciflora* var. *Fernaldii, Carex sterilis, C. scirpoidea* var. *convoluta, C. vaginata, C. eburnea, C. concinna, C. Crawei, C. capillaris, Juncus alpinus* var. *rariflorus, Tofieldia glutinosa, Arenaria stricta, Ranunculus fascicularis, Geum triflorum,* etc. Similarly, the ledges of the Black River, where House got *G. sphaerospermum,* have long been famous for their localized northern calcicoles; it was there or near-by that Crawe, nearly a century ago got *Geum triflorum,* the first and last collection in New York State.

In its subspherical seed with abundant, subuniform, small alveolae, *Geranium sphaerospermum* suggests *G. dissectum* (PLATE 371, FIGS. 1–7) and *G. texanum* (Trel.) Heller (PLATE 372, FIGS. 6–10). Both these species have very small sepals as compared with *G. sphaerospermum* and their seeds are very prominently pitted or reticulate, the alveolae of the newly proposed species barely discernable. In outline of the sepal and its tendency to 5 nerves *G. texanum,* endemic in southern Texas and adjacent Mexico, so far as is known, is the nearest approach to *G. sphaerospermum.* Besides by its small and glabrous (except on the nerves) sepals (FIG. 6) and sharply reticulate seeds (FIGS 8–10) *G. texanum* is characterized by its solitary peduncles scattered in the forks of the stem and by the almost glabrous surface of the carpel-body (FIG. 7). Both *G. texanum* of southern Texas and *G. sphaerospermum* of southern Canada and the northern States are very remote in their characters from *G. carolinianum,* with which they have both been confused.

6. G. CAROLINIANUM L. Internodes, petioles, peduncles and pedicels densely retrorse-hirsute with subuniform hairs mostly less than 0.5 mm. long mixed (on pedicels) with short glands; peduncles solitary in the upper forks or loosely aggregated in 4–12-flowered terminal

corymbs.—Sp. Pl. 682 (1753). *G. atrum* Moench, Meth. 285 (1794). *G. lanuginosum* Jacq. Hort. Schoenb. ii. 8 (1797). *G. Langloisii* Greene, Pittonia iii. 171 (1897).—Dry rocky woods, fields and waste places, Florida to southern California, north to Massachusetts, Connecticut, West Virginia, southern Michigan, Illinois, Missouri, Kansas, Wyoming, Idaho and southern British Columbia. PLATE 373, and 374, FIGS. 7 and 8.

Var. **confertiflorum**, var. nov. (TAB. 374, FIGS. 1–6), laxe villoso-hirsutis pilis plerumque 1 mm. longis; inflorescentiis terminalibus confertis umbelliformi-corymbosis 5–25-floris.—Dry rocky or sandy soil, southern Maine to Wisconsin, south to Delaware, uplands of North Carolina and Tennessee, and Missouri. TYPE: open field, North Amherst, Lorain Co., Ohio, June 22, 1924, *R. J. Webb*, no. 5263 in Gray Herb.

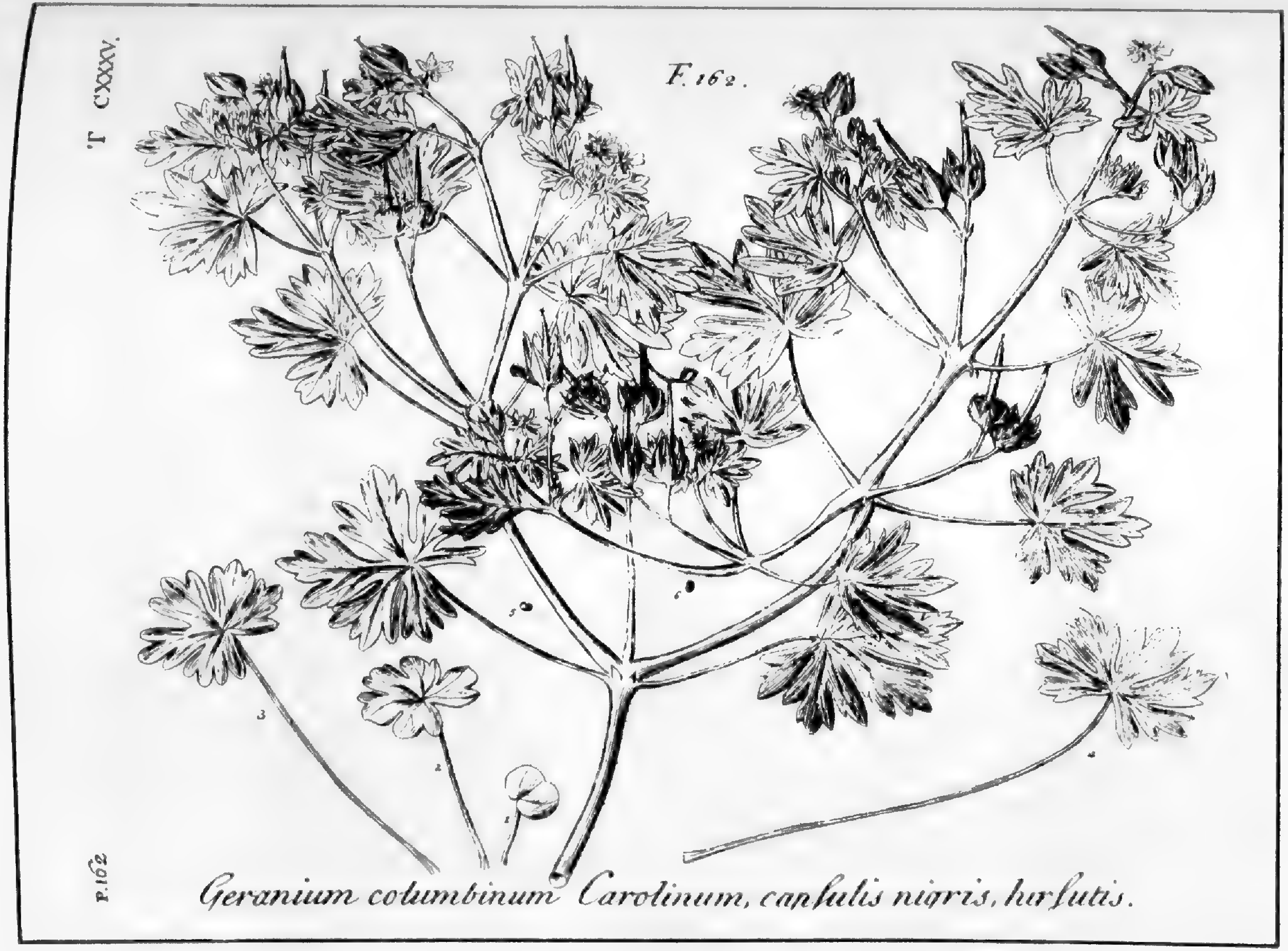
Var. *confertiflorum*, the northeastern extreme of the species, has been passing as typical *Geranium carolinianum*. It is not represented in the Gray Herbarium from either of the Carolinas except from the mountains of North Carolina. It was obviously this northern plant which Greene visualized as *G. carolinianum* when he segregated as a distinct species *G. Langloisii*, the common southern extreme, "canescent with white hairs, these deflexed on the stem, . . . gland-tipped hairs wholly wanting, but the inflorescence minutely glandular . . . distributed as *G. Carolinianum;* but that species has a different mode of growth, a gland-tipped and viscid spreading pubescence," etc. Similarly in the North American Flora, Hanks & Small separate the two in their key as follows:

Inflorescence open, few-flowered . . . . 8. *G. Langloisii.*
Inflorescence compact, many-flowered . . . . 9. *G. carolinianum.*

Geranium carolinianum of Linnaeus was thus defined:

carolinianum. 34. GERANIUM pedunculis bifloris, calycibus aristatis, foliis multifidis, pericarpiis hirsutis. *Roy. lugdb.* 351. *Gron. virg.* 78
Geranium columbinum carolinum, capsulis nigris hirsutis. *Dill. elth.* 162. *t.* 135. *f.* 162.
Habitat in Carolina, Virginia. ☉.

Royen simply referred to the Dillenian description and plate cited by Linnaeus, as did Gronovius who, however, cited a Clayton specimen (no. 372). The Dillenian *Geranium columbinum carolinum* from which the specific name and first locality, Carolina, were obviously derived by Linnaeus, was well and fully described and clearly illustrated. The plate of Dillenius, slightly reduced is here reproduced as our PLATE 373. That it is the southern plant described as *G. Langloisii*, with "Inflorescence open, few-flowered" rather than the more north-



GERANIUM CAROLINIANUM
(Reduced from original plate of *Dillenius*).

Photo. E. C. Ogden.

GERANIUM CAROLINIANUM, var. CONFERTIFLORUM: FIG. 1, portion of fruiting plant (TYPE), × 1; FIG. 6, calyx, × 5; FIG. 2, carpel-body, × 10; FIGS. 3 and 4, seeds, × 10; FIG. 5, surface of seed, × 50.

G. CAROLINIANUM: FIG. 7, seed, × 10; FIG. 8, surface of seed, × 50.

eastern plant with "Inflorescence compact, many-flowered" (var. *confertiflorum*) is evident.

7. G. PYRENAICUM Burm. f. Sp. Geran. 27 (1759). Adventive from Europe: roadside-ditches near Quebec and very locally elsewhere.

8. G. PUSILLUM Burm. f. l. c. (1759). Naturalized from Europe: Massachusetts to southern British Columbia and southward.

9. G. MOLLE L. Sp. Pl. 682 (1753). Adventive from Europe: chiefly in lawns and grass-land, Nova Scotia to British Columbia and southward.

CEANOTHUS OVATUS Desf., var. PUBESCENS T. & G. MICHIGAN: wind-swept crests, crevices and talus of sandstone-conglomerate, West Bluff, Keweenaw Co., no. 3414; sandy barrens west of Norway, Dickinson Co., no. 3415.

The glabrous, typical *Ceanothus ovatus* is well represented from Michigan; I find no records for var. *pubescens*.

C. SANGUINEUS Pursh. MICHIGAN: wind-swept crests, crevices and talus of sandstone-conglomerate, West Bluff, Keweenaw Co., no. 3416; dry, deciduous woods at base of greenstone and calcareous conglomerate bluffs, east of Eagle Harbor, no. 3,417 (shrubs up to 3 m. high).

Recorded from the same general area (Copper Harbor) by Farwell, RHODORA, xvii. 230 (1915). Otherwise very local east of the Pacific Slope. See p. 209 and MAP 6.

VIOLA SEPTENTRIONALIS Greene, var. **grisea**, var. nov. (TAB. 375), foliis lanceolato-deltoideis vel anguste lanceolato-ovatis utrinque griseo-pilosis.—MICHIGAN: dry sandy plain near Driggs, Schoolcraft Co., July 2, 1934, *Fernald & Pease*, no. 3430 (TYPE in Gray Herb.).

Superficially *Viola septentrionalis*, var. *grisea* is so similar to *V. novae-angliae* House that, without close examination, it could readily pass as that species. It has, however, the characteristic capsule and strongly ciliate sepal-auricles (FIG. 3) and the seeds of *V. septentrionalis* and gray pilosity such as is not found in *V. novae-angliae*. Its pubescence is that of the common eastern *V. septentrionalis* but much denser (FIG. 2), whence the name, and its leaf-blades much narrower than in the characteristic eastern plant.

(*To be continued*)

CRITICAL PLANTS OF THE UPPER GREAT LAKES REGION OF ONTARIO AND MICHIGAN

M. L. Fernald

(*Continued from page 301*)

Epilobium paniculatum Nutt., var. **subulatum** (Hausskn.), comb. nov. *E. paniculatum*, forma *subulata* Hausskn. Mon. Gatt. Epilob. 247 (1884). *E. micranthum* Nutt. ex Hausskn. l. c. (1884), not Pall. ex Hausskn. l. c. 102 (1884). *E. Tracyi* Rydb. Bull. Torr. Bot. Cl. xl. 63 (1913). *E. subulatum* (Hausskn.) Rydb. l. c. 64 (1913). —Ontario: Colpoy's Bay, Bruce Co., 1871, *John Macoun;* Hopkins Harbor, Tobermory, Bruce Co., *Krotkov,* no. 7640; crevices and talus of hornblendic cliffs and ledges, Cloche Peninsula, Manitoulin District, no. 3440; about calcareous ledges in dry woods, south of Little Current, Manitoulin Island, no. 3441.

Var. *subulatum* is the extreme of the species about Lake Huron. Typical *Epilobium paniculatum* Nutt. described with "Flowers nearly as large as in E. palustre, pale red" has been collected farther east, along the Ottawa River in Quebec: Deschênes, 14 juillet, 1921, *Rolland,* no. 15,884. It is a coarser plant, with short pedicels and with calyx 5–6 mm. long, the petals longer. Var. *subulatum* was clearly described by Haussknecht (as forma *subulata*) "Floribus parvis,—5 m.m. longis, petalis calyce sublongioribus; calycis tubo brevi, glabro, 2 m. m. longo. Capsulis 2 c. m. longis, glabrescentibus . . . ; pedicellis capillaribus, 1/2: 1 c. m. longis"; etc. It is the small-flowered extreme of a highly variable cordilleran species; but, having long and slender pedicels, contrasted with the short and stouter ones of the large-flowered typical *E. paniculatum,* its identity is obscured by Rydberg's treatment, in setting up *E. subulatum* as a species:

. . . . .pedicels short . . . . .2. *E. subulatum.*
. . . . .pedicels slender. . . . . .3. *E. paniculatum.*

E. Tracyi seems scarcely recognizable as different from *E. paniculatum,* var. *subulatum;* and I fully concur in the second half of Rydberg's statement, when he split *E. paniculatum* into "several forms or species," but all treated as species!, that *E. paniculatum* connects "on one hand with *E. minutum,* on the other with *E. jucundum.*" In defining his *E. paniculatum,* forma *subulata* Haussknecht included among the specimens cited Macoun's collection from Colpoy's Bay.

Chimaphila umbellata (L.) Bart., var. occidentalis (Rydb.) Blake, Rhodora, xix. 242 (1917). *C. occidentalis* Rydb. Michigan: woods, Mackinac Island, *Hunnewell,* no. 9329; openings and thickets back of crest of West Bluff, Keweenaw Co., no. 3458.

Var. *occidentalis* is the geographic variety (species of Rydberg) of the Pacific slope from British Columbia to north-central California, eastward into Montana, thence along the Rocky Mountains to Utah and Colorado. Its discovery in northern Michigan, where it is associated with scores of plants of similarly disrupted range, is at least a significant item.

Vaccinium membranaceum Dougl. in Hook. Fl. Bor.-Am. ii. 32 (1834) as syn.; Britton in Brit. & Br. Ill. Fl. ii. 576, fig. 2785 (1897), validation of the name. *V. myrtilloides*, β. *macrophyllum* Hook. l. c. (1834). *V. macrophyllum* (Hook.) Piper, Contrib. U. S. Nat. Herb. xi. 443 (1906).—The common "huckleberry" of the Upper Peninsula of Michigan is typical *V. membranaceum*, occurring otherwise only west of the continental divide from southwestern Alaska to northwestern Montana and the Coast Ranges of northern California. Its mature leaves are membranous, green on both sides, varying from lance-oval to ovate, acuminate above, 3–7 cm. long, 1.5–3.5 cm. broad. In central and eastern Washington and Oregon it passes gradually into a shrub with smaller leaves, 1–5 cm. long, 1–2.5 cm. broad, firmer, usually paler beneath and of an oblong to elliptic outline, with rounded to merely acutish (not long-acuminate) tips. This is

Var. **rigidum** (Hook.), comb. nov. *V. myrtilloides*, γ ? *rigidum* Hook. Fl. Bor.-Am. ii. 32 (1834). *V. globulare* Rydb. Mem. N. Y. Bot. Gard. i. 300 (1900).—Central Alberta (Lesser Slave Lake) and southern British Columbia to Colorado and Arizona. See p. 210 and map 7.

A specimen, sent by Hooker in 1835 to Jacques Gay and now in the Gray Herbarium, marked *Vaccinium myrtilloides* Hook. Fl. Bor.-Am. is the small-leaved shrub described by Rydberg as *V. globulare*.

Gentiana rubricaulis Schwein. Michigan: glades and openings in thickets bordering calcareous beach of L. Michigan, east of Manistique, no. 3482.

Gentiana rubricaulis, one of the most definite of species, has been quite misinterpreted. Gray, in 1878, partly understood it but he reduced it to varietal rank as *G. linearis*, var. *lanceolata* Gray, Syn. Fl. N. Am. ii.[2] 123 (1878), giving a partially correct description of the true *G. rubricaulis* from "Minnesota along Lake Superior"; but adding "Also Herkimer Co., New York, *Paine*," the latter, as shown by his material, being merely a broadish-leaved *G. linearis* Froel. Subsequently, Gray partly cleared the situation, or perhaps further confused it, by publishing *G. linearis*, var. *latifolia* Gray, Proc. Am.

Acad. xxii. 309 (1887), for the "form from Lake Superior," adding the comment: "I have some reason to suppose that it is also *G. rubricaulis* of Schweinitz from the same region."

The segregation of *Gentiana linearis*, var. *latifolia* properly recognized the plant which is unquestionably what had been described as *G. rubricaulis* Schwein. in Keating's Narr. Long's Exped. ii. 384 (1824); but later authors (Britton and Robinson & Fernald) failed to clarify the situation, the former merging with *G. rubricaulis* the *G. linearis*, var. *lanceolata* from "central New York," the latter placing *G. rubricaulis* in the synonymy of var. *lanceolata*. Schweinitz's description was very clear and fragments of the type, presented many years ago to Asa Gray, show conclusively the identity of his species:

28. Gentiana * *rubricaulis*, L. v. Schw.

Though there were but two specimens of this Gentiana, (one of which I was under the necessity of sacrificing to the examination,) it presents so distinct an appearance that I have little doubt it will prove a new species, intermediate between *G. pneumonanthe* and *G. ochroleuca*. I describe it thus:

Stem erect, simple, terete, very smooth and firm, of a red colour; about one foot in height. *Leaves* about one inch in length, alternately opposite at intervals, oblong-lanceolate, of thick consistency, smooth, entire in margin and slightly undulate, obtuse, sessile and sub-amplexicaule or connate at base, with three nerves, the two lateral ones inconspicuous. The upper leaves forming a pseudo-involucrum of ovate leaves, not exceeding the corollas in length. Involucrum and leaves sub-erect. *Corollas* campanulate, erect, sessile, terminal, fasciculate or single, subquinquefid. Segments sub-connivent, the interior plait with a single tooth. *Calyx* very small in proportion to the flower, 5-fid.

Appears to have been bluish.

G. caule tereti glabro rubro: foliis oblongo-lanceolatis, trinerviis, obtusis. Corollis terminalibus fasciculatis sessilibus, 5-fidis campanulatis non ventricosis, laciniis acutis conniventibus; plicis interioribus unidentatis.

Hab. Prairies of St. Peter's river.

A detailed study shows that this characteristic plant of the Upper Great Lakes region, from western Ontario across northern Michigan to Minnesota, with isolated eastern outliers in Somerset Co., Maine and in Charlotte Co., New Brunswick, is quite distinct from *G. linearis*. The specific distinctness of the two was clearly recognized by Kusnezow who redefined the plants which are really *G. rubricaulis* as *G. Grayi* Kusnezow, Acta Hort. Petrop. xiii. 59 (1893), this later appearing as *Dasystephana Grayi* (Kusnezow) Britton in Britton & Brown, Ill. Fl. ed. 2, iii. 13 (1913), where Britton perpetuated the error of assigning *G. rubricaulis* to the synonymy of *G. linearis* and still further carried on the confusion by stating of his *D. Grayi* that it is "Recorded from central New York." The record from central New York was, of course, that of Paine's broad-leaved (but quite frequent) extreme of *G. linearis*, already discussed. *G. rubricaulis* seems to be particularly common on calcareous areas about Lake Superior and upper Lake Michigan.

Apocynum sibiricum Jacq., var. **cordigerum** (Greene), comb. nov. *A. cordigerum* Greene, Leafl. ii. 164 (1911). *A. Farwellii* Greene, l. c. 168 (1911). *A. hypericifolium* Ait., var. *cordigerum* (Greene) Bég. & Bel. Atti R. Accad. Lincei, V. ix. 114 (1913); Woodson, Ann. Mo. Bot. Gard. xvii. 141 (1930). *A. hypericifolium* Ait., var. *Farwellii* (Greene) Woodson, l. c. 140 (1930). Ontario: limestone pavement and gravel, Great Cloche Island, no. 3484.

Although Woodson treats var. *cordigerum* as a plant of the "upper Mississippi Valley," the representation in the Gray Herbarium shows it to be, likewise, in the drainage of the St. Lawrence and the Hudson to the east, and of the Saskatchewan to the northwest. Thoroughly characteristic specimens are before me from Indiana and Ohio, with a number from New York (south of Tripoli, Lake George region, July 5, 1914, *Burnham;* Newtown Pond, Junius, *Wiegand,* no. 3038; Westbury bog, Butler, *A. H. Wright,* no. 12,759). I am quite unable to see a distinct variety in *A. Farwellii.* Woodson treated it as a variety because it is "pubescent," but the specimens which I have seen (cited by him) have the hairs so few and so localized on the young growth that one must rake the specimens carefully with a lens to find them. In publishing *A. Farwellii* as a species Greene said: "main stem glabrous . . . up to the middle, above that, as also the branches, hirsutulous . . . leaves . . . all glabrous or nearly so above, sparsely fuscous-pubescent beneath." That was Greene's account of one individual, but there was another "in less pubescent, indeed almost glabrous state."

Woodson, quite misinterpreting the International Rules of Botanical Nomenclature, maintained the later name, *A. hypericifolium* Ait. Hort. Kew. i. 304 (1789), and rejected the clearly described and beautifully illustrated *A. sibiricum* Jacq. Hort. Vindob. iii. 37, t. 66 (1770). In apologizing for this irregular procedure he said:

Jacquin published *A. sibiricum* nineteen years previous to the publication of *A. hypericifolium* Ait. Moreover, the description of the former was accompanied by a full-page folio illustration of the habit of the plant. The Latin description of the former, also, was far more elucidating than the unillustrated and terse description of Aiton. However, as can be quickly perceived by a glance at the citations in literature on page 133, botanists were quick to take up *A. hypericifolium* Ait., while *A. sibiricum*

Jacq., perhaps because of the misleading geographical adjective, was disregarded for over a hundred years after its publication. In such a case, the practical course is to follow the so-called "Fifty year rule" tacitly established in the International Code of Nomenclature, and adopt the better-known designation.[1]

Although the motive, to reject an inappropriate name in favor of an appropriate one (as was done by many authors in the days before our existing rules of nomenclature) is commendable, it is certainly difficult to find anything in the International Rules or any other code about a "Fifty year rule" for species. The author doubtless had vaguely in mind the old "Berlin rule," which was the basis for the original list of *nomina generica conservanda.* No specific names are free from the priority principle.

Typical *Apocynum sibiricum* of Jacquin was the erect form, so illustrated and clearly described "Caules annui, erecti . . . sesquipedales." On the sands and gravels of much of Canada and the adjacent states it is quite prostrate, and erect plants are absent or difficult to find. This is

A. sibiricum Jacq., forma **arenarium** (F. C. Gates), comb. nov. *A. hypericifolium,* prostrate, Schaffner, Ohio Nat. x. 184, fig. 1 (1910). *A. hypericifolium,* f. *arenarium* F. C. Gates, Torreya, xi. 128 (1911).

The western American *Apocynum sibiricum* is superficially like the typical plant, in having the middle leaves narrowly oblong to oblong-lanceolate, acute and with merely rounded to cordate bases (instead of oval or broadly ovate-oblong, rounded or obtuse or merely subacute and with cordate-clasping bases as in var. *cordigerum*), but this western extreme has more slender corolla-tube than typical *A. sibiricum* and the coma of the seed is longer. This is

A. sibiricum Jacq., var. **salignum** (Greene), comb. nov. *A. salignum* Greene, Pittonia, v. 64 (1902). *A. hypericifolium,* var. *salignum* (Greene) Bég. & Bel. l. c. 115 (1913); Woodson, l. c. 141 (1930).

Hackelia deflexa (Willd.) Opiz, var. americana (Gray) Fern. & Johnst. Rhodora, xxvi. 124 (1924). Michigan: borders of open woods north of Garden, Delta Co., and on shaded talus of limestone cliff, Burnt Bluff, Delta Co., nos. 3491, 3492.

Previously recorded, either as *Lappula americana* (Gray) Rydb. or *L. deflexa* (Willd.) Garcke from Cheboygan Co.

Mertensia paniculata (Ait.) G. Don, var. subcordata (Greene) Macbride. Michigan: brookside in woods, south of L'Anse, Baraga Co., no. 3493.

[1] Woodson, *A Monograph of the Genus Apocynum.* Ann. Mo. Bot. Gard. xvii. 139 (1930).

In his *Studies in the Boraginaceae, IX*, Contrib. Arn. Arb. iii. 85 (1932), Johnston restricts var. *subcordata* to Washington, Oregon and Idaho. Our material, which he identifies without question as var. *subcordata*, adds another to the long series of identities in the floras of the Pacific slope and of the Upper Great Lakes.

Lithospermum **croceum**, sp. nov. (tab. 376, figs. 1–5). Perenne e radice longe et recte descendenti; caulibus 1.5–6 dm. altis pilosis; foliis subuniformibus lineari-oblongis vel lanceolatis obtusis vel subacutis adscendentibus plerumque 33–45 infra inflorescentiam, majoribus 2–5 cm. longis 3–15 mm. latis utrinque papilloso-hispidis pilis ca. 1 mm. longis; racemis floriferis dense corymbis 3–8 cm. diametro, racemis fructiferis elongatis 1–2 dm. longis strictis; bracteis late lanceolatis vel ovatis foliis similibus calices maturos valde superantibus fructiferis imbricatis; floribus breve pedicellatis; lobis calicis lanceolato-acuminatis valde carinatis papilloso-hispidis fructiferis 10–15 mm. longis; corollis croceis extus pilosis, tubo infundibuliformi exserto ad basin contracto poro minuto intus glabro basi barbato excepta, limbo 1.5–2 cm. diametro lobis oblongo-rotundatis opacis venis confluentibus; fauce vix vel breve appendiculato; staminibus inclusis, filamentis quam antherae oblongae brevioribus; nuculis albidis lucidis 3.5–4 mm. longis.—Sands, gravels and sandy woods, thickets and bluffs near the Great Lakes from western New York and Ontario westward, thence to Montana, South Dakota, Nebraska and Kansas. Type: calcareous sand back of beach of Lake Michigan, east of Manistique, Michigan, July 9, 1934. *Fernald & Pease*, no. 3494 (in Gray Herb.).

Lithospermum croceum is the plant of the sands of the Great Lakes region and of the plains westward and southwestward to Montana, South Dakota, Nebraska and Kansas which long passed as *L. hirtum* (Muhl.) Lehm., then as *L. Gmelini* (Michx.) Hitchc. and more recently as *L. caroliniense* (Walt.) MacMill. Those are all synonymous names and they go back for their typification to *Anonymos caroliniensis* Walt. Fl. Carol. 91 (1788), a characteristic species of the coastal plain from South Carolina to Florida, thence to eastern Texas and adjacent Mexico, Arkansas and Oklahoma.

The southern coastal plain species is finely pilose, the hairs of stem and foliage (fig. 6) much more abundant and less papillose-based than in the inland and more northern species, the lower cauline leaves very much smaller than the middle and upper, the latter well developed leaves only 15–25 below the branching inflorescence, with the midrib dorsally minutely pilose; the branches of the mature inflorescence are loosely ascending or spreading, with the bracts becoming distant; the mature calyx (fig. 7) is slender-pedicelled, the pedicels ultimately

1/3–2/3 as long as the calyx, and the calyx-lobes are flat, with slender midrib and villous (instead of papillose)-hispid; the corolla is larger, paler, and of thinner texture, the limb 2–2.5 cm. broad, the throat with elongate appendages, the outside minutely appressed- or sericeous-pilose, the tube minutely pilose within, the veins (FIG. 8) continuing without evident anastomosing into the lobes. This southern species was first described as *Anonymos caroliniensis* Walt. Fl. Carol. 91 (1788). It was promptly renamed *Batschia caroliniensis* Gmel. Syst. i. 315 (1791) and, in the same year, *Lithospermum carolinianum* Lam. Tab. Encyc. i. 397 (1791). Somewhat later, with the probable desire to honor Gmelin for giving a generic identification to Walter's *Anonymos caroliniensis* and with complete disregard for the principle of priority which later became so important, it appeared as *Batschia Gmelini* Michx. Fl. Bor.-Am. i. 130 (1803). Yet again, regardless of the older and properly published names, Lehmann picked up a *nomen nudum* of Muhlenberg's—*Anchusa hirta* Muhl. Cat. 19 (1813)—and described *Lithospermum hirtum* Lehm. Asperif. ii. 304 (1818) from South Carolina, with the names of Walter, Gmelin and Michaux all cited as synonyms. As if this beautiful species of the southern coastal plain had not been sufficiently named, Rafinesque got it from Florida and described it as *L. strigosum* Raf. New Fl. N. Am. pt. iv. (Neobotanon), 18 (1836) and Alphonse DeCandolle, from a very inadequate Texan specimen, described it as *L. bejariense* A. DC. Prodr. x. 79 (1846). When two of the older names were transferred as *L. caroliniense* (Walt.) MacMillan, Metasp. Minn. Val. 438 (1892) and as *L. Gmelini* (Michx.) Hitchc., Spring Fl. Manhattan, 30 (1894), their authors had before them local material of *L. croceum*. NOMENCLATURALLY, however, their combinations finally rest upon *Anonymos caroliniensis* Walter from South Carolina.

Yet the quite distinct northern and inland plant was regularly confused with the southern species and among the surplus of names proposed I can find none which designates it; nearly every one was content to rename the plant of South Carolina which Walter had originally described. In its very harsh pubescence *L. bejariense* A. DC. from eastern Texas, an isotype of which is before me, suggests *L. croceum*, but *L. bejariense* has the abruptly smaller lower leaves, the scattered fruiting bracts, the plane calyx-lobes and the characteristic venation of throat and lobes of the corolla of *L. caroliniense*; and it is apparently a variation of the latter species, to which it was properly assigned by Johnston, Contr. Gray Herb. lxx. 31 (1924).

Photo. E. C. Ogden.

VIOLA SEPTENTRIONALIS, var. GRISEA: FIG. 1, fruiting plant (TYPE), × 1; FIG. 2, base of expanding leaf, × 10; FIG. 3, cleistogamous fruit, showing ciliate sepal-auricles, × 10.

Photo. E. C. Ogden.

LITHOSPERMUM CROCEUM: FIG. 1, small flowering plant (TYPE), × ½; FIG. 2, fruiting stem, × ½; FIG. 3, back of bract, × 10; FIG. 4, fruiting calyx, × 4; FIG. 5, base of corolla-lobe and summit of tube, × 10.

L. CAROLINIENSE: FIG. 6, back of bract, × 10; FIG. 7, fruiting calyx, × 4; FIG. 8, base of corolla-lobe and summit of tube, × 10.

Plate 376, fig. 1 shows a small flowering plant, × 1/2 from the type collection of *Lithospermum croceum;* fig. 2, the top of a fruiting plant, × 1/2, from Illinois; fig. 3, a portion of the back of a bract, × 10, of the type, to display characteristic pubescence; fig. 4, a fruiting calyx, × 3, to show the keel and the stiff ciliation of the calyx-lobes; fig. 5, the venation of the opaque corolla-lobe, × 10, cleared for photographing by boiling in alcohol and then mounting in glycerine. The other figures, representing details of *L. caroliniense,* are noted in a preceding paragraph.

Hedeoma hispida Pursh. Michigan: sand plain south of Iron Mountain, Dickinson Co., no. 3501.

Beal cites only a single station, near the southeastern corner of the state.

Collinsia parviflora Lindl. To the stations already recorded from the Keweenaw Peninsula add: wind-swept crests, crevices and talus of sandstone-conglomerate, West Bluff, Keweenaw Co., nos. 3512 (large, still flowering on July 4), 3513 (small, with capsules open).

Mimulus moschatus Dougl. To the records from northern Michigan add: seepy bank in rich, deciduous woods, Delaware, Keweenaw Co., no. 3514.

Farwell had already collected *Mimulus moschatus* at Delaware in 1885 (his no. 277, from banks of brooks and moist places, "Indigenous to the Keweenaw Peninsula." He made a similar memorandum on his no. 5975 from streams near Lake Linden. In northern Michigan as elsewhere in the East, notably in Newfoundland and on the Magdalen Islands, the species seems to be indigenous.

Veronica scutellata L., var. villosa Schumacher. Ontario: by pool in argillaceous swale near Warren, Sudbury District, no. 3517.

In Rhodora, xxiii. 38 (1921) Pennell reduces the pubescent plant to formal rank, as forma *villosa* (Schumacher) Pennell, and states that it "occurs sporadically occasional throughout the range of the species." It may be so, but in nearly fifty years of intimate knowledge of *V. scutellata* in the area from Labrador and Newfoundland to western New York and Virginia, I had never seen the pubescent plant growing until I went to Lake Huron in the summer of 1934. In the very extensive collections of the Gray Herbarium and of the New England Botanical Club it is not represented from Labrador, Newfoundland, the Maritime Provinces, Quebec and New England, whence it should have been collected if present. All the material in the Gray Herbarium is from the Great Lakes area and the Puget

Sound area (western New York to Lake Superior; southwestern British Columbia, Vancouver Island and northwestern Washington). This range is so nearly identical with that of many other plants of the Great Lakes region that I am inclined to retain var. *villosa* as a geographic variety. When John Macoun described it as var. *pubescens* Macoun, Cat. i. 361 (1884) he knew it only from Belleville on Lake Ontario, saying: "It is the only form found there." This was the case, likewise, at the pool in Warren.

Utricularia geminiscapa Benj. (*U. clandestina* Nutt.). Michigan: pools with *Potamogeton Oakesianus* Robbins, *Eleocharis Robbinsii* Oakes, *Eriocaulon septangulare* With., *Drosera intermedia* Hayne, etc. in bog near Rock River, Alger Co., no. 3521.

Perhaps the first record from Michigan; already known in Wisconsin.

Plantago Purshii R. & S. Michigan: sandy open pine barrens north of Gladstone, Delta Co., no. 3524.

Apparently the first record from the Upper Peninsula. The plant seemed to be a part of the indigenous flora.

Lonicera villosa (Michx.) R. & S., var. Solonis (Eaton) Fernald, Rhodora, xxvii. 6 (1925). Michigan: arbor-vitae swamp near Eckerman, no. 3527.

When I studied the variations of *Lonicera villosa*, I had var. *Solonis* from Isle Royale but not from the mainland of Michigan.

Virburnum affine Bush. Michigan: wind-swept crests, crevices and talus of sandstone-conglomerate, West Bluff, Keweenaw Co., no. 3537.

When Blake, Rhodora, xx. 14 (1918), divided *Virburnum affine*, he recognized the glabrous-leaved typical form from Ontario, Illinois, Minnesota, etc., but not from Michigan; the Michigan shrub recognized by him being var. *hypomalacum* Blake, l. c.

Aster nemoralis Ait. Michigan: larch swamp near Emerson, Chippewa Co., no. 3550.

Although Beal lists *Aster nemoralis* as "Common Th [roughout]," I find no other record of it from Michigan, nor has a specimen from so far west previously reached the Gray Herbarium.

Antennaria rupicola Fern. See Rhodora, xxxv. 342, 343, map 26, where no stations were indicated on the Great Lakes, except at the northwest side of Lake Superior. The following are more easterly. Ontario: limestone pavement and gravel, Great Cloche Island, Manitoulin District, no. 3556; dry soil, Jack Fish, Thunder Bay Distr., *Pease & Bean*, no. 23,475; roadside, Schreiber, *Pease & Bean*, no. 23,597.

Adenocaulon bicolor Hook. To the comparatively few recorded stations about the Upper Great Lakes add: Ontario: Cape Croker, Indian Peninsula, Bruce Co., July, 1895, *A. Y. Massey* (Can. Nat. Herb.). Michigan: deciduous woods between Rock River and Sand River, Alger Co., no. 3562; rich, deciduous woods (with *Polystichum Lonchitis*), Delaware, Keewenaw Co., no. 3563. See p. 210 and maps 8 and 9.

Coreopsis lanceolata L. Ontario: in great profusion and very showy on talus of hornblendic cliffs and ledges, Cloche Peninsula, Manitoulin Distr., no. 3564.

This station (very extensive) is recorded, since Macoun (Cat.) cited only vague and somewhat general areas, without definite localities.

C. lanceolata, var. villosa Michx. Michigan: sandy barrens west of Norway, Dickinson Co., no. 3566.

Apparently not recorded from north of Illinois.

The Varieties of Tanacetum huronense (Plates 377 and 378).—The native tansy of eastern North America occurs in five widely segregated areas. The typical plant, described by Nuttall from "sandy shores of Lake Huron, near Michilimakinak; abundant," occurs on the sands and gravels of Lakes Huron, Superior and Michigan. Never properly represented in the Gray Herbarium, the Great Lakes plant has been considered inseparable from the plant of the St. John valley in Quebec, New Brunswick and Maine and the adjacent (and formerly confluent) valley of the Restigouche, a plant abundantly represented in the Gray Herbarium and the herbarium of the New England Botanical Club. Our collection of the typical Great Lakes plant is now, happily, augmented and it is clear that the isolated plant of the St. John and Restigouche valleys is a strongly marked geographic variety. Farther east, on the river-gravels of Anticosti, the plant combines the characters of the typical Great Lakes variety and that of the St. John and the Restigouche, while the plant from dunes of James Bay and eastern Hudson Bay seems to be that of Anticosti. Farthest east, the usually monocephalous and densely lanate plant of the west coast of Newfoundland, var. *terrae-novae*, exhibits the most extreme departure from the type of the species.

The characters of these four geographic varieties of *Tanacetum huronense* are briefly stated below and the plates bring out the essential differences.

a. Flowering stem 4–8 dm. high, with 7–15 green leaves: corymb with 6–30 heads: leaves oblong, with oblong to oblanceolate pinnae . . . . Var. *typicum*.
a. Flowering stem 0.4–4.5 dm. high: corymb with 1–6 heads . . . . *b*.
b. Leaves oblong to narrowly elliptic, the larger 4–10 cm. long, 2–5 cm. broad; the pinnae oblong to oblong-oblanceolate, blunt, with approximate to imbricated pinnules . . . . *c*.

c. Flowering stems 1.2–3 dm. high, glabrous to sparingly pilose (except at summit), with 4–10 green and sparsely pilose leaves above the basal rosette: heads 2–6. . . . . Var. *bifarium.*

c. Flowering stem 0.4–2 dm. high, copiously lanate, with 1–4 white-lanate leaves above the basal rosette: heads 1 or 2 (rarely –4) . . . . Var. *terrae-novae.*

b. Leaves (especially the basal and median) elliptic, the larger 1–3 dm. long, 0.35–1.4 dm. broad; pinnae remote, with remote simple to much dissected acute pinnules: flowering stems 2–4.5 dm. high, with 5–10 leaves and 1–5 heads. Var. *johannense.*

T. HURONENSE Nutt., var. **typicum** (PLATE 377, FIGS. 1 and 2). *T. huronense* Nutt. Gen. No. Am. Pl. ii. 141 (1818).—Sands and gravels of Lakes Huron, Michigan and Superior.

Var. **bifarium,** var. nov. (TAB. 377, FIGS. 3 et 4), var. *typico* simillima a qua differt caulibus 1.2–3 dm. altis glabris vel sparse pilosis; foliis caulinis 4–10 sparse pilosis oblongis vel anguste ellipticis majoribus 6–10 cm. longis 2–5 cm. latis, pinnis oblanceolatis obtusis, pinnulis obtusis; capitulis 2–6.—Anticosti Island, QUEBEC: sur les platières de l'embouchure, Rivière Jupiter, 10 août 1926, *Victorin & Rolland,* no. 25,177; sur les platières au-dessus des gorges, Rivière Chicotte, 15 août 1926, *Victorin & Rolland,* no. 25,176; sur les platières, R. des Caps, 25 juillet 1927, *Victorin & Rolland,* no. 27,566; sur les platières argilo-calcaires, avec *Solidago Victorinii,* R. McKane, 30 juillet 1927, *Victorin & Rolland,* no. 27,564 (TYPE in Gray Herb.). UNGAVA DISTR.: east coast of Hudson Bay, Smith Sound, August 24, 1928, *Malte,* no. 120,894; sandy shore of Hudson Bay, Port Harrison, August 18–20, 1928, *Malte,* no. 120,720; sand dunes near the Post, Charlton Island, July 6, 1929, *David Potter,* no. 25.

Var. TERRAE-NOVAE Fernald, RHODORA, xxv. 14 (1923). PLATE 378, FIGS. 1–4. Peaty turfy or gravelly limestone barrens of western Newfoundland, in typical development from the shore of Pistolet Bay to Ingornachoix Bay; the plant of Cape St. George approaching var. *bifarium.*

Var. **johannense,** var. nov. (TAB. 378, FIGS. 5 et 6), foliis imis mediisque late ellipticis majoribus 1–3 dm. longis 0.35–1.4 dm. latis, pinnis remotis, pinnulis remotis acutis simplicibus vel valde dissectis; caulibus 2–4.5 dm. altis; foliis caulinis 5–10; capitulis 1–5.—Gravels and sands of the St. John River and tributaries, Quebec, Maine and New Brunswick, and of the Restigouche River, New Brunswick and Quebec. TYPE: river-gravels and shingly border of thicket by the St. John River, Woodstock, New Brunswick, July 14, 1916, *Fernald & Long,* no. 14,860 (TYPE—four sheets—in Gray Herb.).

ARNICA (CORDIFOLIAE) **Whitneyi,** sp. nov. (TAB. 379, FIGS. 1–5), rhizomate gracili perlongo horizontali vel subadscendente stolonifero; caule solitario 1.7–4 dm. alto sparse villoso, pilis albidis ad 2 mm. longis glandulis minutis commixtis; foliis basilaribus late ovatis vel subrotundatis membranaceis utrinque sparse pilosis 5.5–10 cm. longis 4.5–8 cm. latis, basi valde cordatis sino angusto, margine remote

Photo. E. C. Ogden.

TANACETUM HURONENSE, var. TYPICUM: flowering stem and basal leaf, × 2/5, from Michigan; FIG. 2, achene, × 10, from Lake Superior.
T. HURONENSE, var. BIFARIUM: FIGS. 3 and 4, flowering plant and basal rosette, × 2/5, from Anticosti.

Photo. E. C. Ogden.

TANACETUM HURONENSE, var. TERRAE-NOVAE: FIGS. 1–3, flowering plants, × 2/5; FIG. 4, achene, × 10; all from Newfoundland.
T. HURONENSE, var. JOHANNENSE: FIG. 5, flowering branch, × 2/5; FIG. 6, achene, × 10, from New Brunswick.

breviterque serrato-dentato, apice subacuto vel rotundato, petiolo gracile 6–12 cm. longo glanduloso-villoso; foliis caulinis 2–3-jugis, imis longe petiolatis basilares simulantibus, mediis similibus breviter petiolatis basi cordatis vel subcordatis, superioribus reductis ovatis vel lanceolatis subintegris acutis basi rotundatis sessilibus vel breve petiolatis; pedunculis 1–3 nudis vel bracteatis, bracteis lineari-lanceolatis caudato-attenuatis; capitulis 2.5–5 cm. diametro; involucro 1.2–1.8 cm. alto basi dense albido-villoso supra glanduloso laxeque villoso; bracteis 8–12 lineari-oblanceolatis 2–3 mm. latis apice deltoideo-acuminato; ligulis luteis, lamina 1.2–1.8 cm. longa 4–6 mm. lata 7–9-nervata apice breviter 3-dentata dentibus vix 1 mm. longis; corollis disci 8 mm. longis, tubo villoso 3–4 mm. longo basi obcupuliformi, cupula glabra 0.6–0.7 mm. alta; achaeniis nigris 7 mm. longis strigoso-hirsutis basi anguste albido-annulatis, annulo 0.1 mm. lato; pappo albido 8–11 mm. longo, setis barbellulatis.—Keweenaw County. MICHIGAN: Copper Harbor, 1849, *W. D. Whitney* in Gray Herb.; dry deciduous woods near Copper Harbor, July 4, 1934, *Fernald & Pease*, no. 3579 (TYPE in Gray Herb.); dry, deciduous woods at base of greenstone and calcareous conglomerate bluffs, east of Eagle Harbor, July 6, 1934, *Fernald & Pease*, no. 3580.

Arnica Whitneyi, as beautiful a plant as any in the genus, is named for its discoverer, WILLIAM DWIGHT WHITNEY, 1827–1894. In his report on Botany in Foster, J. W., and Whitney, J. D., Rep. Geol. Lake Superior Land District, ii. Chap. xxi, 368 (1851), W. D. Whitney recorded it as *A. mollis* Hook. from Copper Harbor; and his material (the upper half of a plant preserved in the Gray Herbarium) has been the basis of subsequent reports of *Arnica* from Michigan: as *A. Chamissonis* of Gray, Man. ed. 2, issue of 1859, and later eds., from Lake Superior, and of Beal & Wheeler's Michigan Flora; as *A. lanceolata* of Britton, Man. and of Beal, Flora of Michigan; as *A. cordifolia* of Fernald, RHODORA, vii. 150, from Copper Harbor (*Whitney*) and of Robinson & Fernald in Gray, Man. ed. 7; as *A. mollis* of Britton in Britton & Brown, Ill. Fl. ed. 2, from Lake Superior.

The white, merely barbellulate pappus of the fragmentary Whitney specimen clearly separates his plant from *Arnica Chamissonis* Less. and *A. mollis* Hook. (including *A. lanceolata* Nutt.) which have brownish or olivaceous plumose pappus. The beautiful new material, with characteristic basal leaves, shows that the relationship of *A. Whitneyi* is with *A. cordifolia* Hook. and its cordilleran segregates. The Keweenaw plant, however, seems very distinct from *A. cordifolia* and its described allies.

In typical *A. cordifolia* (FIGS. 6–9), as shown by an authentic specimen sent by Hooker in 1835 to Jacques Gay and now preserved in the Gray Herbarium (Hooker had published the species in 1834) and by a large series of specimens from the cordilleran region, the basal leaves are merely cordate, subcordate or subtruncate at base, with broad and open sinuses, and the marginal teeth are very coarse; the middle and upper cauline leaves are mostly deltoid-ovate, the upper sometimes rhombic, and with prolonged tips; and the pubescence of the stem, peduncles and involucres rarely shows much of the glandular admixture which is so abundant on and which gives a heavy, oily odor to *A. Whitneyi*. In *A. cordifolia* the involucral bracts (fig. 6) are usually more broadly oblanceolate than in *A. Whitneyi* (fig. 2) and without the abundant glands on the surface; the ligules (fig. 7) are broader (up to 1 cm. broad), with sharper and longer terminal lobes (the longer 1.5–3 mm. long); the disk-corollas (fig. 8) are coarser (9–11 mm. long), the tube with a conical, rather than inverted-cuplike base; and the slightly coarser achenes (fig. 9) have the basal annulus heavier and thicker.

These numerous characters, though largely of degree, set the Keweenaw plant off so definitely from its cordilleran allies that it seems better to treat it as a species than as an isolated variety which differs in ten or more recognizable characters. Its nearest relationship is certainly with *Arnica cordifolia;* the other recognized members of the *Cordifoliae* (all cordilleran) are more remote from it. In Keweenaw County *A. Whitneyi* was closely associated with the ubiquitous *Aster macrophyllus* L. Where the Arnica made large patches of sterile shoots with their characteristic foliage, it was necessary to exercise caution not to collect rosettes of the Aster!

In view of the discovery of *Arnica Whitneyi* in 1849 by the young botanist who then was dividing his interest between natural history and philology, later to become one of our most distinguished philologists,[1] it is most appropriate that the rediscovery of this beautiful

[1] In 1849, William Dwight Whitney went as botanist on the Lake Superior expedition of his older brother, Josiah Dwight Whitney. "Up to this time, as has already been intimated, his interests lay mainly in the direction of the natural sciences. But an event was now about to occur which was destined to change the course of his studies and to determine his whole future. In 1847, his elder brother, Professor J. D. Whitney, had returned from Germany, where he had been devoting himself to the science [geology] in which he has become distinguished. Yet while there he had not limited his attention to it, but had given up a good deal of time to language. Among the books he brought back with him was a copy of the second edition of Bopp's Sanscrit Grammar. This work attracted the attention of his younger brother, and aroused a keener interest than he had before felt in any particular subject. In the winter of the following year he began the systematic study of Sanscrit. For him this was the parting of the ways. In June, 1849, indeed, he joined an expedition sent out by the United States government to explore the region about Lake Superior. One of its two directors was his elder brother, and to the future philologist were assigned

plant should have been shared by a later distinguished philologist, Arthur Stanley Pease, who finds his chief diversion in botany.

Cirsium palustre (L.) Scop. Michigan: border of wet woods, Lawson, Marquette Co., no. 3582; low woods, Michigamme, no. 3583; and seen in similar habitats to Houghton Co.

Cirsium palustre in northern Michigan is either indigenous (as it appears to be in Newfoundland)[1] or, if introduced, has remarkably succeeded in selecting habitats where it simulates indigenous species. Its behavior in Michigan (whether it suddenly spreads or remains quiescent) should be watched.

Krigia biflora (Walt.) Blake, forma **glandulifera,** f. nov., pedunculis superne glanduliferis.—With or apart from the typical glabrous-peduncled form of the species. Type: dry sandy spruce and pine barrens near Humboldt, Michigan, July 3, 1934, *Fernald & Pease,* no. 3584, in Gray Herb.

Typical *Krigia biflora* (Walt.) Blake, Rhodora, xvii. 135 (1915), has glabrous peduncles. So far as shown in the Gray Herbarium all the specimens from New England to West Virginia are without glands. Some from Kentucky, North Carolina and Tennessee have glandular peduncles; others, often of the identical collection (on the same sheet) are glandless. In the Great Lakes region, thence westward to Colorado, glandular peduncles occur on about one-third of the specimens in the herbarium. Here, again, glabrous and glandular peduncles are sometimes on the same sheet. All the material we saw in northern Michigan had the glands well developed. I cannot, however, look upon these plants as more than a recognizable form. They surely are not a separate species. Upon the collection of Bronson Barlow from Turin, Marquette Co., Michigan, June 21, 1901, was based *Cynthia falcata* Standley, Contrib. U. S. Nat. Herb. xiii. 356 (1911). One of the Barlow sheets is before me and I cannot separate it from much typical *Krigia biflora* except in glandular peduncles. Standley, in publishing *Cynthia falcata,* separated it solely on the "prominently aquiline-serrate upper leaves," the upper leaves of *Cynthia virginica*

the barometrical observations, the botany, and the charge of the accounts. But he took with him also his copy of Bopp, and the leisure moments he enjoyed during the expedition were, as far as possible, devoted to the fuller study of that work."—T. R. Lounsbury, *William Dwight Whitney,* Proc. Am. Acad. xxx. 580, 581 (1895).

In view of the frequent assumptions that W. D. Whitney, botanist of the Lake Superior expedition of 1849, was really J. D. Whitney, the distinguished geologist (the "W" being considered a misprint), and since the botanical report is entered in bibliographies merely under W. D. Whitney, the above excerpt from Professor Lounsbury's sketch is quoted as satisfactorily clearing the identity.

[1] See Fernald, Rhodora, xxxv. 15 and 369 (1933).

(*Krigia biflora*) said to be entire. In his proposed new species the "fruit is as in *C. virginica* . . . A very different plant . . . , readily distinguished by the peculiar toothing of its leaves."

In the Barlow sheet in the Gray Herbarium the uppermost leaves (bracts) are entire, but the median and lower leaves have prominent divergent to curving variable teeth. Such teeth are seen on our collection from Gladstone, Michigan (*F. & P.*, no. 3585) which, accordingly, would be *Cynthia falcata*. They occur on numerous other specimens with glandular peduncles and upon many with the peduncles glabrous: from Southbury, Connecticut; Mohegan, New York; Mount Bethel, Pennsylvania; Webster Co., West Virginia; Milwaukee, Wisconsin; Rantoul, Illinois, etc. The character depended upon by Standley as his fundamental specific one is too fickle. The plants with strongly developed glands are at least recognizable and may have some ecological significance. To take up Standley's specific epithet *falcata* to designate a *glandular* form would be quite misleading and is wholly unnecessary. Similarly, to take up for a glandular form of nearly transcontinental range the name *C. viridis* Standley, l. c. 357 (1911), given to the plants of New Mexico and Arizona (occurring also in Colorado) because of a reputed greener color, would be inappropriate. Consequently, I have given a new name and have designated a different type.

EXPLANATION OF PLATES 352–380

Plates 352–354. Sufficiently explained in the legends.

Plate 355. Phyllitis Scolopendrium (L.) Newm.: fig. 1, frond, × ½, from Larmor's Glen, Dundonald, Ireland, August 12, 1884, *R. L. Praeger;* fig. 3, portion of stipe, × 10, from Ennis, Co. Clare, Ireland, *Tidestrom*, no. 11,256; fig. 5, margin of fond, × 10, from Savoy, ex herb. Thurber.

P. Scolopendrium var. americana, n. var.: fig. 2, frond, × ½, from Perryville, Madison Co., New York, August, 1903, *House;* fig 4, portion of stipe, × 10, from Ingalls Falls, Grey Co., Ontario, *Fernald*, no. 3040 (type); fig. 6, margin of frond, × 10, from White Lake, east of Jamesville, New York, *Wiegand*, no. 5374.

Plate 356. Cryptogramma crispa (L.) R. Br., var. acrostichoides (R. Br.) C. B. Clarke: reproduction of original plate of *C. acrostichoides* in Hooker & Greville, Icones Filicum, i. t. xxix.

Plate 357. Cryptogramma crispa, var. Brunoniana (Wallich) Fern.: reproduction of original plate of *C. Brunoniana* in Hooker & Greville, Icones Filicum, ii. t. clviii.

Plate 358. Pteridium aquilinum (L.) Kuhn, var. lanuginosum (Bong.) Fern., forma decipiens (Lawson) Fern.: portion of plant, × ⅗, from Caribou Hill, Black Lake, Megantic Co., Quebec, *Fernald & Jackson*, no 11,961.

Plate 359. Festuca ovina L.: fig. 1, panicle, × 1, from Glåmos, Norway, 1925, *Dyring;* fig. 2, spikelet, showing anthers, × 5, from Forked River, New Jersey, May 27, 1891, *J. R. Churchill.*

F. ovina, var. duriuscula (L.) Koch: fig. 3, pancile, × 1, from Cambridge, Massachusetts, June 8, 1884, *Walter Deane;* FIG. 4, spikelet, showing anthers, × 5, from Albany, New York, June 6, 1912, *S. H. Burnham.*

F. SAXIMONTANA Rydb.: FIG. 5, panicle, × 1, from Jack Fish, Thunder Bay Distr., Ontario, *Pease & Bean*, no. 23,332; FIG. 6, spikelet, showing anthers, × 5, from no. 23,332.

F. BRACHYPHYLLA Schultes: FIG. 7, panicle, × 1, from Craig Harbor, Ellesmere Island, *Malte*, no. 118,370; FIG. 8, spikelet, showing small anther, × 5, from Craig Harbor, Ellesmere Island, *Malte*, no. 118,372.

F. SUPINA Schur: FIG. 9, spikelet, showing anthers, × 5, from Petrak, Fl. Bohem. et Morav. Exsicc. no. 717.

F. VIVIPARA (L.) Sm.: FIG. 10, panicle, × 1, from Little Quirpon, Newfoundland, *Wiegand, Gilbert & Hotchkiss*, no. 27,385; FIG. 11, spikelet, showing awnless lemmas, × 5, from no. 27,385.

F. CAPILLATA DC.: FIG. 12, panicle, × 1, from Grand Falls, Newfoundland, *Fernald & Wiegand*, no. 4669; FIG. 13, spikelet, showing anthers, × 5, from Murray's Pond, Newfoundland, 1931, *A. M. Ayre.*

PLATE 360. CAREX GARBERI, n. sp.: FIG. 1, small plant, × 1, from Manistique, Michigan, *Fernald & Pease*, no. 3183; FIG. 2, orifice of sheath, × 5, from no. 3183; FIG. 3, spike, showing obtuse scales, × 5, from no 3183; FIG 4, staminate base of terminal spike, showing obtuse scales, × 5, from Presque Isle, Pennsylvania, June 9, 1869, *Garber* (ISOTYPE); FIG. 5, denuded rachis, × 10, from *Fernald & Pease*, no. 3183; FIG. 6, perigynium, × 10, from ISOTYPE.

C. GARBERI, var. BIFARIA, n. var.: FIG. 11, portion of plant, × 1, from River Ste. Anne des Monts, Quebec, August 3–17, 1905, *Collins & Fernald* (TYPE); FIG. 12, perigynium, × 10, from TYPE.

C. HASSEI Bailey: FIG. 7, portion of spike, showing sharp scales, × 5, from San Bernardino, California, *S. B. Parish*, no. 5219; FIG. 8, staminate base of terminal spike, showing large, acute scales, × 5, from no. 5219; FIG. 9, orifice of sheath, × 5, from no. 5219.

C. AUREA Nutt.: FIG. 10, portion of spike, to show distant flowers, × 5, from Charlotte, Vermont, June 12, 1878, *F. H. Horsford.*

PLATE 361. ZIGADENUS GLAUCUS Nutt.: FIG. 1, flowering plant, × ⅖, from Scotty Bay, Mackinac Co., Michigan, *Ehlers*, no. 648; FIG. 2, portion of inflorescence, showing firm bracts, × 2, from L'Anse Pleureuse, Gaspé Co., Quebec, *Kelsey & Jordan*, no. 55; FIG. 3, capsule, × 2, from Cap Blanc, Percé, Quebec, *Collins, Fernald & Pease* (*Pease*, no. 5567).

Z. ELEGANS Pursh: FIG. 4, flowering plant, × ⅖, from mountains (at 10,500 ft.) near Cottonwood Lake, Lincoln Co., Wyoming, *Payson & Armstrong*, no. 3774; FIG. 5, portion of inflorescence, showing scarious bracts, × 2, from Leeds, North Dakota, July 3, 1899, *Lunell;* FIG. 6, capsule, × 2, from French Creek, Albany Co., Wyoming, *Goodding*, no. 2036.

PLATE 362. RIBES CYNOSBATI L.: FIG. 2, fruiting branch, × 1, from Stowe, Vermont, July 8, 1908, *R. W. Woodward.*

R. CYNOSBATI, var. ATROX, n. var.: FIG. 1, fruiting branch, × 1, from Little Current, Manitoulin Island, Ontario, *Fernald & Pease*, no. 3358 (TYPE).

PLATE 363. RUBUS PARVIFLORUS Nutt., × 1/10, in border of mixed woods, Bête Grise, Keweenaw Co., Michigan.

PLATE 364. RUBUS PARVIFLORUS Nutt., var. GENUINUS: FIG. 1, young calyx, × 10, and FIG. 2, portion of mature sepal, × 10, showing the long villosity hiding the glands, from Mackinac Island (type-locality), Michigan, July 1881, *T. E. Boyce.*

Var. VELUTINUS (Hook. & Arn.) Greene: FIG. 3, peduncle, × 10, from California, *Ross*, and FIG. 4, lower surface of young leaf, × 10, to show the dense villosity, from California, *Thos. Coulter*, no. 147.

Var. HYPOMALACUS, n. var.: FIG. 5, lower surface of leaf, × 10, showing characteristic pubescence, from Olympic Mts., Washington, *J. M. Grant*, no. 211 (TYPE). NOTE: The pubescence of var. *bifarius* is similar.

Var. HETERADENIUS, n. var.: FIG. 6, portion of pedicel and calyx, × 10, showing the long glands, from near Victoria, British Columbia, June, 1896, *C. E. Cummings.* NOTE: The pedicel and calyx of var. *hypomalacus* are similar. Fig. 7, lower surface of leaf, × 10, from Falcon Valley, Washington, *Suksdorf*, no. 1758 (type). Note: The lower surfaces in vars. *grandiflorus* and *scopulorum* are similar.

Plate 365. Rubus parviflorus Nutt., var. grandiflorus Farwell: fig. 4, portion of pedicel and calyx, × 10, showing glandularity intermediate between that of vars. *heteradenius* and *scopulorum*, from Lead City, South Dakota, *Rydberg*, no. 655. Note: The pedicels and calyx of var. *bifarius* are similar.

Var. scopulorum (Greene) Fern.: fig. 5, pedicel, × 10, showing the very abbreviated glands, from La Plata Cañon, Colorado, *Baker, Earle & Tracy*, no. 680.

Var. parvifolius (Gray) Fern.: fig. 1, two plants, × ⅖, from Pecos River National Park, New Mexico, *Standley*, no. 4032; fig. 2, calyx and summit of pedicel, × 10, showing essential lack of glands, from Santa Fé Creek, New Mexico, *Fendler*, no. 208 (type): fig. 3, lower surface of leaf, × 10, showing reduction of pubescence, from the type.

Plate 366. Chamaerhodos Nuttallii Pickering, var. keweenawensis, n. var.: fig. 1, plant, × 1, of type-collection, West Bluff, Keweenaw Co., Michigan, *Fernald & Pease*, no. 3376; fig. 2, branch, × 10, showing pubescence, from type.

C. Nuttallii: fig. 3, branch, × 10, to show pubescence, from type-locality, Mandan, North Dakota, June 23, 1912, *O. A. Stevens*.

Plate 367. Potentilla fruticosa L., forma villosissima, n. f.: fig. 1, fruiting branch, × 1; fig. 2, leafy branch, × 1; fig. 3, branchlet, × 3; all from Great Cloche Island, Ontario, *Fernald & Pease*, no. 3382 (type).

Plate 368. Geum virginianum L.: type (plant of *Hortus Upsaliensis* in Herb. Linnaeus). Photograph from Mr. S. Savage, Assistant Secretary, Linnean Society of London.

Plate 369. Geum aleppicum Jacq.: reproduction from Jacquin, Ic. Pl. Rar. i. t. 93.

Plate 370. Geum aleppicum Jacq.: fig. 2, portion of fruiting head, showing villous achenes, × 4, from Nízké, Tatry Mts., Slovakia, *Domin & Krajina*, Fl. Cechoslov. Exsicc., no. 272; fig. 3, achene, × 10, from Lyck, East Prussia, July 1, 1858, *C. Sania*.

G. aleppicum, var. strictum (Ait.) Fern.: fig. 1, small fruiting plant, showing variation of basal leaves, × ⅖, from Willoughby, Vermont, July 18, 1896, *E. F. Williams;* fig. 4, portion of fruiting head, showing sparsely pubescent achenes, × 4, from Kidstone Island, Nova Scotia, *Fernald & Long*, no. 21,521; fig. 5, achene, × 10, from Richmond, New Hampshire, September 8, 1926, *C. F. Batchelder*.

Plate 371. Geranium dissectum L.: fig. 1, calyx, × 5, of *G. laxum* Hanks, from Friday Harbor, San Juan Islands, Washington, *Zeller*, no. 834; fig. 2, carpel-body, × 5, from Biltmore, North Carolina, *Biltmore Herb.*, no. 4868; fig. 3, seed, × 10, from Tyrone, Ireland, 1896, *Leebody;* fig. 4, seed, × 10, of *G. laxum* Hanks, from near Milwaukie, Oregon, *Suksdorf*, no. 2450; fig. 5, seed, × 10, from *Biltmore Herb*, no. 4868; fig. 6, surface of seed, × 50, from Tyrone, Ireland, *Leebody;* fig. 7, surface of seed, × 50, of *G. laxum* Hanks, from *Suksdorf*, no. 2450.

G. Bicknellii Britton: fig. 8, calyx, × 5, from Bathurst, New Brunswick, July 25, 1902, *Williams & Fernald;* fig. 9, seed, × 10, from West Roxbury, Massachusetts, *Floyd*, no. 1041; fig. 10, seed, × 10, from Sorrento, Maine, July 27, 1889, *G. G. Kennedy;* fig. 11, surface of seed, × 50, from Sorrento.

G. Bicknellii, var. longipes (Wats.) Fern.: fig. 12, calyx, × 5, from Seely Lake, Montana, *Kirkwood*, no. 1836; fig. 13, peduncle and pedicel, × 10, from type, Washatch Mts., Utah, *Watson*, no. 206; fig. 14, peduncle and pedicel, × 10, from isotype of *G. nemorale* Suksdorf, West Klickitat Co., Washington, *Suksdorf*, no. 2058; fig. 15, carpel-body, × 5, from Ione, Washington, *Kreager*, no. 406; fig. 16, seed, × 10, from Washington, *G. R. Vasey*, no 217; fig. 17, seed, × 10, from Blue Mts., Walla Walla Co., Washington, August 2, 1896, *Piper;* fig. 18, surface of seed, × 50, from last specimen.

PLATE 372. GERANIUM SPHAEROSPERMUM, n. sp.: FIG. 1, portion of fruiting plant, × 1, from TYPE, Great Cloche Island, Ontario, *Fernald & Pease*, no. 3405; FIG. 2, calyx, × 5, from TYPE; FIG. 3, carpel-body, × 10, from TYPE; FIG. 4, seed, × 10, from TYPE; FIG. 5, surface of seed, × 50, from TYPE.

G. TEXANUM (Trel.) Heller; FIG. 6, calyx, × 5, from TYPE, New Braunfels, Texas, *Lindheimer;* FIG. 7, carpel-body, × 10, from Corpus Christi, Texas, *Tracy*, no. 9215; FIG. 8, seed, × 10, from no. 9215; FIG. 9, seed, × 10, from TYPE; FIG. 10, surface of seed, × 50, from TYPE.

PLATE 373. GERANIUM CAROLINIANUM L.: Copied (reduced) from Dillenius, Hort. Elth. t. 135.

PLATE 374. GERANIUM CAROLINIANUM L., var. CONFERTIFLORUM, n. var.: FIG. 1, portion of fruiting plant, × 1, from TYPE, North Amherst, Ohio, *R. J. Webb*, no. 5263; FIG. 6, calyx, × 5, from Alexandria, Virginia, *Wiegand & Manning*, no. 1692; FIG. 2, carpel-body, × 10, from Warwick, Rhode Island, June 25, 1910, *Fernald;* FIG. 3, seed, × 10, from TYPE; FIG. 4, seed, × 10, from New Bedford, Massachusetts, *E. W. Hervey;* FIG. 5, surface of seed, × 50, from TYPE.

G. CAROLINIANUM L.: FIG. 7, seed, × 10, of *G. Langloisii* Greene, from Gretna, Louisiana, *Ball.* no. 301; FIG. 8, surface of seed, × 50, from no. 301.

PLATE 375. VIOLA SEPTENTRIONALIS, var. GRISEA, n. var.: FIG. 1, fruiting plant, × 1, from Driggs, Michigan, *Fernald & Pease*, no. 3430 (TYPE); FIG. 2, base of expanding leaf, × 10, from TYPE; FIG. 3, cleistogamous fruit, to show ciliate auricles of sepals, × 10, from TYPE.

PLATE 376. LITHOSPERMUM CROCEUM, n. sp.: FIG. 1, small flowering plant, × ½, from east of Manistique, Michigan, *Fernald & Pease*, no. 3494 (TYPE); FIG. 2, fruiting stem, × ½, from Topeka, Illinois, August 22, 1904, *Gleason;* FIG. 3, back of bract, showing characteristic pubescence, × 10, from Pelee Island, Ontario, August 20, 1914, *MacDaniels & Eames;* FIG. 4, fruiting calyx, showing prominent costa, × 4, from Southampton, Ontario, *Macoun*, no. 54,342; FIG. 5, portion from summit of tube and base of corolla-lobe, to show characteristic reticulate venation, × 10, from TYPE.

L. CAROLINIENSE (Walt.) MacM.: FIG. 6, back of bract, showing characteristic pubescence, × 10, from Columbia, South Carolina, *Canby*, no. 75; FIG. 7, fruiting calyx, showing flat sepals, × 4, from near Antlers, Pushmatah Co., Oklahoma, *E. J. Palmer*, no. 39,403; FIG. 8, portion from summit of tube and base of corolla-lobe to show characteristic non-reticulate venation, × 10, from *Canby*, no. 75.

PLATE 377. TANACETUM HURONENSE Nutt., var. TYPICUM: FIG. 1, flowering stem and basal leaf, × ⅖, from Manistique, Michigan, *Fernald & Pease*, no. 3567; FIG. 2, achene, × 10, from Lake Superior, *Loring*.

Var. BIFARIUM, n. var.: FIG. 3, flowering plant, × ⅖, from Rivière McKane, Ile d'Anticosti, Quebec, *Victorin & Rolland*, no. 27,564 (TYPE); FIG. 4, basal leaves, × ⅖, from Rivière des Caps, Anticosti, *Victorin & Rolland*, no. 27,566.

PLATE 378. TANACETUM HURONENSE Nutt., var. TERRAE-NOVAE Fern.: FIGS. 1–3, flowering plants, × ⅖, from St. John Island, Newfoundland, *Fernald et al.*, no. 29,201; FIG. 4, achene, × 10, from Sandy Cove, Ingornachoix Bay, Newfoundland, *Fernald, Long & Dunbar*, no. 27,157.

Var. JOHANNENSE, n. var.: FIG. 5, flowering branch, × ⅖, from St. John River, Westfield, New Brunswick, *Fernald*, no. 2262; FIG. 6, achene, × 10, from St. John River, Woodstock, New Brunswick, *Fernald & Long*, no. 14,860.

PLATE 379. ARNICA WHITNEYI, n. sp.: FIG. 1, small flowering plant and basal rosette, × ⅖, from Copper Harbor, Michigan, *Fernald & Pease*, no. 3579 (TYPE); FIG. 2, portion of involucre, × 2, from Eagle Harbor, Michigan, no. 3580; FIG. 3, tip of ligule, × 2, from TYPE; FIG. 4, disk-corolla, × 5, from TYPE; FIG. 5, achene, × 5, from TYPE.

A. CORDIFOLIA Hook.: FIG. 6, portion of involucre, × 2, from Carson, Colorado, *C. F. Baker*, no. 312; FIG. 7, tip of ligule, × 2, from Druid Peak, Yellowstone National Park, *Nelson & Nelson*, no. 5805; FIG. 8, disk-corolla, × 5, from Pyramid Lake, Jasper Park, Alberta, *J. M. Macoun*, no. 96,019; FIG. 9, achene, × 5, from Ross Hole, Montana, *S. Watson*, no. 232.

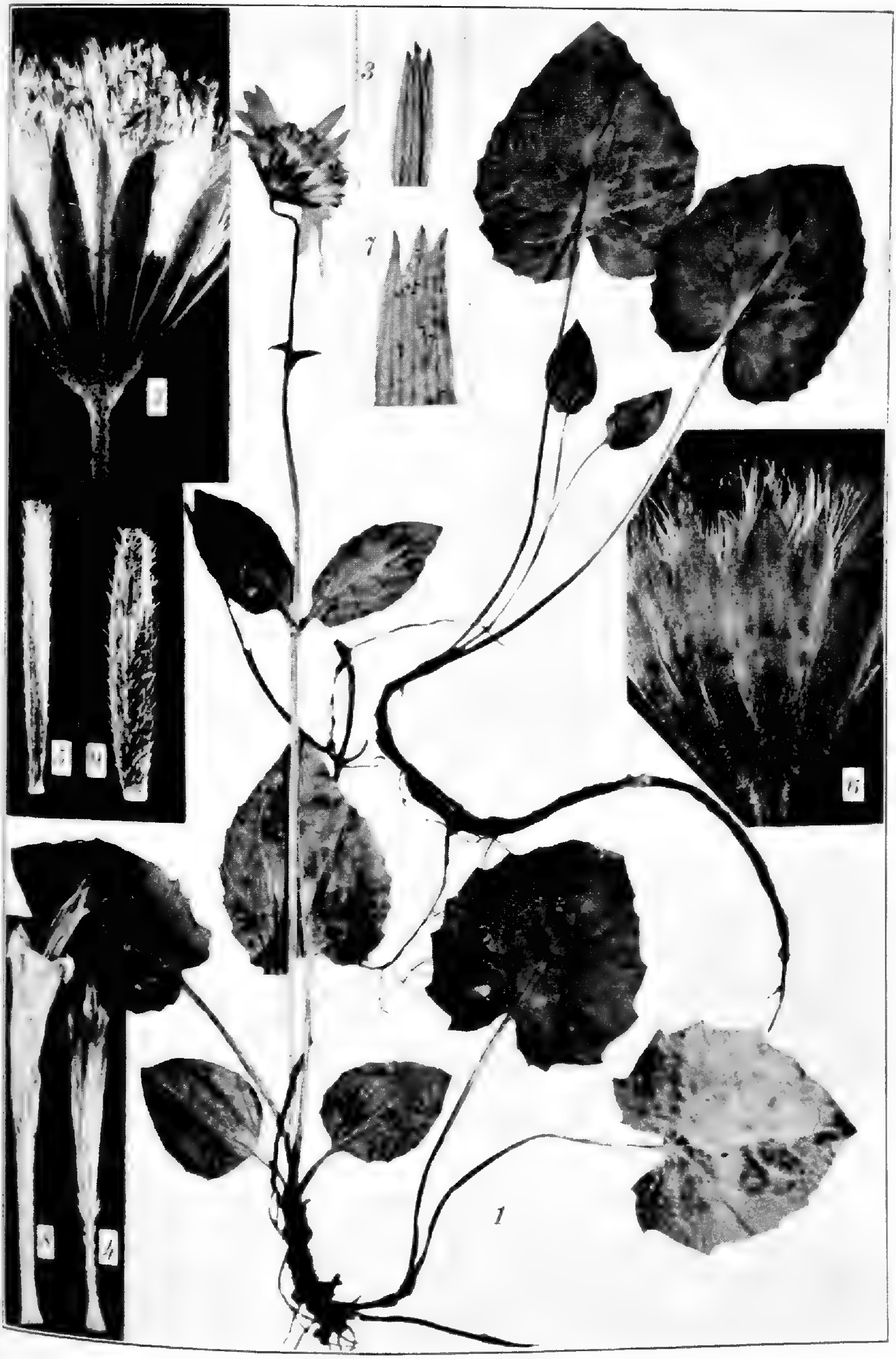


Photo. E. C. Ogden.

Arnica Whitneyi: fig. 1, small flowering plant and basa rosette, × 2/5; fig. 2, portion of involucre, × 2; fig. 3, tip of ligule, × 2; fig. 4, disk-corolla, × 5; fig. 5, achene, × 5; all from Michigan (type).

A. cordifolia: fig. 6, portion of involucre, × 2, from Colorado; fig. 7, tip of ligule, × 2, from Wyoming; fig. 8, disk-corolla, × 5, from Alberta; fig. 9, achene, × 5, from Montana.

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CONTRIBUTIONS FROM THE GRAY HERBARIUM OF HARVARD UNIVERSITY.

CIX

MIDSUMMER VASCULAR PLANTS OF SOUTHEASTERN VIRGINIA

By M. L. FERNALD

DATES OF ISSUE

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" 423–454 and Plates 394–405 .... 2 December, 1935

CONTRIBUTIONS FROM THE GRAY HERBARIUM OF HARVARD UNIVERSITY—NO. CIX.

MIDSUMMER VASCULAR PLANTS OF SOUTHEASTERN VIRGINIA

M. L. Fernald

(Plates 384–405)

Stimulated by the success of the brief botanical trip to Princess Anne and Norfolk Counties, Virginia, made by Mr. Griscom and me in September, 1933, and reported upon in the paper, *Three Days of Botanizing in Southeastern Virginia*,[1] I induced Mr. Bayard Long to join me for a midsummer trip to the same area in 1934. Mr. Griscom being then in Europe it was necessary to forego his always cheerful and stimulating companionship. Accompanied by my son, Mr. Henry G. Fernald, as chauffeur and photographer, Mr. Long and I reached Virginia Beach on July 27. We had expected to stay four or five days but the pressure of interesting plants and those new to the area forced us to prolong the stay until August 9; and even then, on our last half-day in the field we brought in more than a score of species not previously reported from Princess Anne County. When we left, therefore, we were fully aware of the vast amount of exploration still needed and the desirability of further studies in the region.

[1] Fernald & Griscom, Rhodora, xxxvii. 129–157, 167–189. plates 332–351. Contrib. Gray Herb. no. cvii (1935).

The hot midsummer days, with temperatures daily reaching or exceeding 37.7° C (100° F) and an atmospheric humidity near 80, are the feast-times of chiggers (red-bugs) and ticks. Consequently, the call for a minimum of clothing, coupled with the necessity for perfect protection against invaders, strongly convinced us that, climatically at least, the region was one in which the austro-riparian flora should luxuriate. Kearney, in his very detailed study of the area, *Report on a Botanical Survey of the Dismal Swamp Region*,[1] has already so satisfactorily described the country, its climate and vegetation that it is necessary here merely to refer to that preliminary publication. Covering a vastly greater area than we and concentrating on the Dismal Swamp, which we barely reached in our westernmost collecting, Kearney had a broad outlook upon the whole flora but, naturally, he could not detect local spots of great interest but limited extent which we were able to find. Other such spots are doubtless numerous but as yet undetected by the botanist; and, surely, many areas once of great botanical interest are now hopelessly lost to the botanist through the deep ditching which has generally prevailed. Thus, the extensive area of the Green Sea, thence across the formerly wet stretch of almost uninhabited country between Grassfield and Cornland, the area at the northeast edge of the Dismal Swamp, bounded by Wallaceton, Northwest, Great Bridge and the Herring Canal, must originally have been a region of boggy pinebarren; but today, wherever not under cultivation, it is a hopelessly uninteresting cane- or reed-brake. By sheer good luck we got into one limited spot in this area which had not yet quite dried out. Here the Savannah or Pond Pine, *Pinus serotina* Michx., a species not seen by Kearney, still persists in spite of the draining; and in this remnant of a once extensive area of wet barrens we found the last lingering relics of the original flora: *Panicum lucidum* Ashe, *Cyperus retrorsus* Chapm., var. *Deeringianus* (Britton & Small) Fern. & Griscom, *Rynchospora microcephala* Britton, *R. gracilenta* Gray, *Carex venusta* Dew., var. *minor* Boeckl. and *Ludwigia pilosa* Walt. and *L. linearis* Walt., all but the last species not seen by Kearney. Many species of wet or dry pinebarrens, unsupported by modern (or?any) authenticating specimens, have been included in our northern Manuals as occurring in southern Virginia (*Mayaca Aubleti* Michx., *Syngonanthus flavidulus* (Michx.) Ruhl., *Bartonia verna* (Michx.) Muhl., etc.). It is quite clear that the proper habitats for such plants have been largely exterminated through draining and subsequent cultivation of the land.

[1] Thomas H. Kearney, Contrib. U. S. Nat. Herb. v. no. 6, pp. 321–585 (1901).

Another factor which is rapidly destroying the remnants of native vegetation which still linger in southeastern Virginia is the universal custom of turning rich woodlands into pig-pastures or dumps. So long as Man feels as he generally does, that the earth and its natural products were God-given to Man for his personal exploitation and destruction it is perhaps hopeless to expect any of Nature's wonderful gifts to be preserved for later generations. But it is not man and pig alone who are making the havoc. The ubiquitous and unrestrained Japanese Honeysuckle, *Lonicera japonica,* is doing its utmost to strangle everything which originally grew in the borders of wooded swamps or thickets. Even the strongly armored species of *Smilax* become hopelessly entangled by it and more delicate shrubs and herbs are soon obliterated. If the "CCC" survives, nothing more beneficial to future generations in our Southeast could be devised than a vigorous warfare against the Japanese Honeysuckle, the ruthless and exterminating "yellow peril" of the South.

Other limited areas with highly specialized floras were found. As distinctive as any is a small patch of peaty, sandy and slightly boggy swale between the backs of the coastal dunes and the fresh-water ponds south of the Rifle Range, below Rudy Inlet (between Virginia Beach and Dam Neck). Search from Cape Henry to the North Carolina border, below False Cape, has failed to reveal another spot like it, with its concentration of local plants of damp sands and peats, the following of them not reported by Kearney from this region of Virginia: *Axonopus furcatus* (Flügge) Hitchc., *Panicum ensifolium* Baldw., *Gymnopogon brevifolius* Trin., *Rynchospora rariflora* (Michx.) Ell., *R. cymosa,* var. *globularis* Chapm., *R. Wrightiana* Boeckl., *Juncus Elliottii* Chapm., a remarkable new *Hypoxis,* not closely related to other American species, *Sabatia gracilis* (Michx.) Salisb., and *Lobelia Nuttallii* R. & S.

Farther south, in the damp depressions in the sand between Back Bay and the dunes of False Cape is another area of localized coastal plain plants, the following noteworthy as not in Kearney's report from the county: *Cyperus Haspan* L., *Dichromena colorata* (L.) Hitchc., *Eleocharis albida* Torr. and *E. Lindheimeri* (Clarke) Svenson (extension east from Texas), *Rynchospora caduca* Ell., *Juncus megacephalus* M. A. Curtis, *Ranunculus hederaceus* L., *Ludwigia brevipes* (Long) E. H. Eames, *Hydrocotyle ranunculoides* L. f. and, extended south from the head of Chesapeake Bay, *Limosella subulata* Ives.

The rich woodlands, as already noted by Mr. Griscom and me,

Photo. E. C. Ogden.

Asplenium platyneuron: fig. 3, pinnae, $\times$ 1.
A. platyneuron, var. euroaustrinum: fig. 1, plant, $\times \frac{2}{5}$; fig. 2, pinna, $\times$ 1.

Photo. E. C. Ogden.

Sagittaria Weatherbiana: fig. 1, flowering plant and separate inflorescence, × ½ (type); fig. 2, dilated filaments and anthers, × 10, from type; figs. 3–6, mature achenes, × 10.

contain many species of the interior most unexpected on the outer edge of the coastal plain, close to the Atlantic. Several such species are enumerated by Kearney. Our browsings brought to light many other plants of rich woods, several of them amazingly remote from their inland centers: *Thelypteris hexagonoptera* (Michx.) Weath., *Panicum Boscii* Poir., *Liparis liliifolia* (L.) Richard, *Goodyera pubescens* (Willd.) R. Br., *Aristolochia Serpentaria* L., *Arenaria lanuginosa* (Michx.) Rohrb., *Aquilegia canadensis* L., *Asimina triloba* (L.) Dunal, *Agrimonia parviflora* Ait. and *A. mollis* (T. & G.) Britton, *Angelica villosa* (Walt.) BSP., *Sabatia brachiata* Ell., *Galium uniflorum* Michx., *Vernonia glauca* Willd. and *Antennaria Parlinii* Fern., *A. fallax* Greene and *A. solitaria* Rydb. Isolation from the interior is well illustrated by *Vernonia glauca*, a characteristic plant, as Small expresses it, of "Wooded slopes and riverbanks, various provinces N of Coastal Plain, Ga. to Ala., Pa. and N. J." Yet in the woods near Little Creek it is less than a mile from the sea.

From these introductory notes it will be apparent that the southeastern counties of Virginia still support a flora of real interest, one which we are just beginning to know, although the activities of Man have severely diminished it. In view of the very detailed list already published by Kearney it will be useful to have on record all species collected by us which he did not record from our limited area (Princess Anne and Norfolk Counties) and which were not recorded in the paper by Griscom and me. The numbers cited are of herbarium specimens collected as vouchers. We spent one night before reaching Virginia Beach at Wachapreague in Accomac County. Although Accomac County is north of the entrance to Chesapeake Bay a few records of range-extensions there are here included. In a few cases additional stations discovered by Mr. Griscom and me in September, 1933 (and not previously reported) or in May, 1935, or by Griscom, Long and myself in June, 1935, are included; but in the main the later collections await further study before a report upon them will be justified.

The accompanying report contains numerous technical plates, the photographs, chiefly by Mr. E. C. Ogden, made possible through a grant from the Milton Fund for research of Harvard University. The expense of their reproduction has been most generously met by Mr. Bayard Long.

Enumeration of Noteworthy Species Collected[1]

Thelypteris noveboracensis (L.) Nieuwl. Frequent, often abundant, in rich woods, both counties: Little Neck, Princess Anne Co., no. 3608.

T. palustris Schott, var. pubescens (Lawson) Fern. Swamps or inundated woods, frequent in both counties: north of Blackwater River, no. 3610.

T. hexagonoptera (Michx.) Weath. Moist or swampy woods, Little Neck, no. 3609. Seen in 1935 in abundance on Great Neck and nearer Virginia Beach.

Asplenium platyneuron (L.) Oakes. Frequent in woodlands, northern half of Princess Anne Co.: rich woods east of Little Creek, no. 3602.

Asplenium platyneuron (L.) Oakes, var. **euroaustrinum**, var. nov. (tab. 384, figs. 1 et 2), frondibus fertilibus submembranaceis 2–5 dm. longis 3–7.5 cm. latis; pinnis anguste lanceolatis apice acutis vel subacutis valde serratis; soris maturis distinctis non confluentibus.—Florida to Louisiana, north to Kentucky and southeastern Virginia. Type: rich, mixed woods, Munden, Princess Anne Co., Virginia, August 1, 1934, *Fernald & Long*, no. 3603 (in Gray Herb.).

Var. *euroaustrinum* is the extreme development, gigantic for the species, in the warm region of the southeastern United States. Its most important character is in the remote sori which, when fully ripe, remain distinct, instead of becoming promptly confluent as in the wide-ranging typical *Asplenium platyneuron*. The latter is frequent to common in eastern Virginia in good soils; but var. *euroaustrinum* was seen by us only in woodlands of most austral aspect at the extreme southeastern corner of the state but it was collected by Heller in Southampton Co., about Franklin, *Heller*, no. 1147. All material in the Gray Herbarium from Florida belongs to var. *euroaustrinum*. For comparison mature pinnae from typical *A. platyneuron*, our no. 3602, from east of Little Creek, Princess Anne Co., is included in the plate as fig. 3.

I am retaining *Asplenium platyneuron* (L.) Oakes in order to avoid further changes in the nomenclature of the common species which for two generations has been passing under that name. The history and the application of the name are about as shaky as any of the Linnean definitions of American plants, based upon confused and quite inadequate knowledge. Nomenclaturally *Asplenium platyneuron* rests upon *Acrostichum platyneuron* L. Sp. Pl. ii. 1069 (1753), a treatment copied directly (with the omission of the original diagnosis) from the

[1] Unless otherwise designated the collectors are *Fernald & Long;* the collections of *Fernald & Griscom* are cited as of *F. & G.;* those of *Fernald, Griscom & Long* as of *F. G. & L.*

dissertation on *Acrostichum* of Linnaeus's pupil, Johann Benjamin Heiligtag, and published in L. Amoen. Acad. i. 156 (1749).

The treatment in Heiligtag's dissertation was as follows:

> 10. *ACROSTICHUM frondibus pinnatis, pinnis alternis ovatis crenatis sessilibus sursum arcuatis. Gron. virg.* 123.
> *Filix Polypodium dicta minima virginiana platyneuros. Pluk. alm.* 153. *t.* 289. *f.* 2. *Raj. app.* 58.
> *Asplenium virginianum, polypodii facie. Raj. app.* 59.
> *Polypodium minus virginianum, foliis brevibus subtus argenteis. Moris. hist.* 3. *p.* 563. *s.* 14. *t.* 2. *f.* 6.
> Habitat in *Virginia.*
> *Facies* Polypodii officinarum.
> *Stipites* nudi, alterni, palmares.
> *Frons* pinnata lobis alternis, obtusis, integerrimis, obverse ovatis, aut oblongis, sursum arcuatis, basi coadunatis; aversa foliorum pars alba pulvere ferrugineo adspersa.
> *Morisoni* datum synonymon huc spectat, licet ipse hoc idem conjungat cum specie octava.

The account in Species Plantarum was essentially identical but ended with "*Habitat in* Virginia."

Taking up the citations as they are given in Species Plantarum, the first, *Acrostichum frondibus alternatim pinnatis, foliolis ovatis crenatis sessilibus, sursum arcuatis* of Gronovius, was based primarily upon Clayton's no. 14 (*Trichomanes foliis minoribus, caule nigro splendente*). The Clayton specimen, studied by Asa Gray in 1839, was recorded by him on the margin of the copy of Gronovius used by him for that purpose as *Asplenium ebeneum* Ait. That identification, the only satisfactory evidence that *Acrostichum platyneuron* was an *Asplenium*, was promptly taken as typifying the species; and, since this typification was accepted without question by Moore, Hooker, D. C. Eaton and others, it is better to let it so stand.

The other bases of *Acrostichum platyneuron* are wholly a sad mixture of *Polypodium virginianum* L. and *P. polypodioides* (L.) Watt. *Filix Polypodium dicta minima Virginiana platyneuros* of Plukenet, from which the specific name *platyneuron* was, obviously, taken, rests on a conventionalized figure of a *Polypodium virginianum.* This figure shows a rachis somewhat exaggerated by shadow, which could well be described "platyneuros." Ray took over the Plukenet species and added to the citation "*vide* Asplenium Virginianum Polypodii facie *D. Pet.*" This plant, the 2nd listed by Linnaeus as identical with that of Clayton (or Gronovius), was well described by Ray as a hand's breadth high, with the pinnae as in *Polypodium,* the fruit as in *Asplenium* (possibly meaning something quite outside our present

Asplenium), the fruiting side of the frond whitish and roughened with ferruginous dots (Seminalia autem exanthemata ferruginei coloris non sunt sed albicantes punctulis ferrugineis aspera). The latter character could have been drawn only from *Polypodium polypodioides;* yet Ray went on to state that his species is Plukenet's *Filix Polypodium dicta minima Virginiana platyneuros,* already shown to be the smooth *P. virginianum.* Morison's *Polypodium minus virginianum, foliis brevibus subtus argenteis* was likewise undoubted *P. polypodiodes;* the figure is unequivocal and the description is perfect.

Returning to the original (or compiled) diagnosis in the dissertation on *Acrostichum,* it is clear that Linnaeus and his student, Heiligtag, were confused: "*Facies* Polypodii officinarum" was certainly a sufficient indication of *Polypodium;* "*Stipites* nudi, alterni, palmares" actually describes the stipes of *Polypodium virginianum,* not the very short and tufted stipes of the *Asplenium;* "lobis . . . integerrimis, obverse ovatis . . . sursum arcuatis" is perfectly good for *Polypodium,* not for the *Asplenium;* and surely "aversa foliorum pars alba pulvere ferrugineo adspersa," the phrase taken right out of Ray, could apply to nothing but *Polypodium polypodioides.*

If we typify *Acrostichum platyneuron* by most of the literary references and by the clear but compiled diagnosis in Amoen. Acad. we can arrive only at a mixture of *Polypodium virginianum* and *P. polypodioides,* both bearing Linnean specific epithets dating from 1753. Only by ignoring all the confused and quite misunderstood references to *Polypodium* and putting the weight on the plant of Clayton which Gronovius described, which Linnaeus studied (but misunderstood) and which Gray, Moore, Hooker and others selected as the true basis of *Acrostichum platyneuron,* can we save the name in its current application. In view of the consensus of good usage it is wisest to let it so stand; but the case is a perfect one to place before those philosophical but usually botanically inexperienced enthusiasts who think that typification or elucidation of the muddled concepts of early authors can be properly accomplished by means of a single RULE. A rule which in one case would conserve an established usage in another would do the opposite, unless we can agree that in these old and obscure medleys typification was accomplished by the student who first selected one element to stand as typical. Such a rule as that would conserve most names. A rule which arbitrarily designates the first citation or the first plate or the diagnosis would often do havoc to usage. The diagnosis of *Acrostichum platyneuron,* for example, applies not to *Asplenium* but to two species of *Polypodium.*

Athyrium asplenioides (Michx.) Desv. Common in moist woods and swamps, highly variable in size, attenuation of pinnae and color (green or rufescent): Little Neck, nos. 3604, 3605; Oceana, no. 3606.

Botrychium virginianum (L.) Sw. Rich woods, occasional in both counties: Little Neck, no. 3612; east of Little Creek, *F. & G.*, no. 4291; near Benefit, *F. & G.*, no. 4292.

All the material has more oblong and blunter pinnules than the plant of the Northeast and of the Alleghenian region. It is presumably typical *B. virginianum*, the type of which is now being compared with it in London.

B. dissectum Spreng. Dry, mixed woods, Little Neck, no. 3613.

B. dissectum, forma obliquum (Muhl.) Fern. With the latter, no. 3614.

Lycopodium inundatum L., var. Bigelovii Tuckerm. Damp or wet peaty or sandy depressions near the coast: The Desert, Cape Henry, no. 3615; Rifle Range, south of Rudy Inlet, no. 3616.

Pinus serotina Michx. Common in wet peaty soil of southern Norfolk Co., from the northeast corner of the Dismal Swamp eastward across the Green Sea: south of Grassfield, no. 3618.

Typha angustifolia L., var. elongata (Dudley) Wiegand (var. *virginica* Tidestrom.). Marshes and margins of ponds and creeks, Princess Anne Co.: margin of Owl Creek, Virginia Beach, no. 3621.

One of Tidestrom's original collections of his var. *virginica* was from Cape Henry.

Typha truxillensis HBK. Nov. Gen. et Sp. i. 68 (1815). *T. latifolia *domingensis* Pers. Syn. ii. 532 (1807). *T. domingensis* (Pers.) Kunth, Enum. iii. 92 (1841). Virginia: border of salt marsh by Back Bay, Munden, no. 3623; border of Nowney Creek, Back Bay, *F. G. & L.*, no. 4530. North Carolina: brackish marsh of Back Bay, east of Morse Point, Currituck Co., no. 3622, *F. G. & L.*, no. 4529.

Typha truxillensis is very conspicuous on the brackish marsh, near the causeway leading from south of Munden to Knott's Island, North Carolina and Virginia. It there grows in intimate association with *T. angustifolia* L., and the contrast between the two could hardly be better demonstrated: *T. angustifolia* comparatively low, with few dark-green, subherbaceous, plano-convex leaves and deep reddish-brown spikes; *T. truxillensis* twice as tall, the 10± very pale and coriaceous flat leaves overtopped by the whitish-brown spikes, so very tall as to give special point to two of the names under which it has passed: *T. gigantea* Schur (1865) and *T. maxima* Schur (1905). After collecting and photographing *T. truxillensis* within the limits of North Carolina we made a point of visiting the marshes of Back Bay slightly to the north, within Virginia, where it is equally abundant.

In mid-June, 1935, it was barely in anthesis, whereas *T. latifolia* and *T. angustifolia* were in young fruit (with staminate flowers shriveled).

Typha truxillensis (as *T. domingensis*) is recorded by Graebner in Engler's Pflanzenr. iv[8]. 14 (1900) from temperate[1] and tropical South America, Central America and the West Indies, northward to southern California, Texas and Louisiana. It is in the Gray Her-

[1] In view of the abundance of *Typha truxillensis* (*T. domingensis*) in temperate South America, it is difficult to understand the statement of Mr. J. Hutchinson (Fam. Fl. Pl. ii. Monoc. 128 (1934)): "Typha; absent from America and Africa south of the equator." There are many specimens of *T. truxillensis* (often misidentified as *T. angustifolia* and even as *T. latifolia*) in the Gray Herbarium from southern Brazil, Uruguay and Argentina, from between lat. 30° and 35° S. In his *Contributions to the Flora of North Patagonia*, Journ. Linn. Soc. xxi. 236 (1884), John Ball wrote of it (as *T. angustifolia*): "Extends from the valleys of North Patagonia through the provinces of Buenos Ayres and Entrerios." A sheet of this material in the Gray Herbarium is typical *T. truxillensis*. But Ball's conclusion regarding the dispersal of "This cosmopolitan species" should be modified, since *T. truxillensis* is purely American. In 1894, Kronfeld in Martius, Fl. Bras. iii[3]. 642, gave the range of *T. domingensis:* "Habitat in Americae regionibus inter 35. circulum parall. longitudinis septentrionalis et Patagoniam sitis inclusa India occidentalis"; and he cited many specimens from south of the equator. Graebner in Pflanzenr. iv[8] gives *T. domingensis* a similar range: "südlich bis nach Buenos-Aires und Nordpatagonien." Our collections extend the range to lat. 36° 40′ N.

As to the absence of *Typha* from "Africa south of the equator," reference merely to *Index Kewensis*, Kronfeld's monographic study in 1889 and Graebner's treatment in Das Pflanzenreich would have been sufficient to show that *T. capensis* came from South Africa, that *T. latifolia*, proles *Hildebrandtii* occurs only on Madagascar and that *T. angustifolia*, subsp. *australis* grows in Zanzibar, the Transvaal and at the Cape of Good Hope!

Unfortunately others of Hutchinson's statements of the geographic areas occupied by groups have to be carefully checked or treated with easy-going liberality: for instance, his brief summaries under *Lophotocarpus* (p. 34), the *Xyridaceae* (pp. 61 and 63) and *Hemerocallis* (p. 91). The broad range of the *Xyridaceae* (the genus *Xyris*) is given: "Warmer regions of the world, usually in saline marshes; numerous species in Florida." I have personally known *Xyris* in the field for nearly half-a-century, but I never saw it in *saline* soil. Small, including the "numerous species [about 20] in Florida," rightly assigns them all fresh habitats, 15 of the species in "pinelands," which are not saline. Of the 28 species in *Flora Brasiliensis* only 1 is assigned a possibly maritime habitat (with no statement that it is saline). "Trop. and Subtropics," given as the range of *Xyris*, surely needs some qualification as a statement of the occurrence of a genus ranging from 42° S. lat. to 50° N. lat. Similarly "Tropics generally" for *Lophotocarpus*, which grows northward to northeastern New Brunswick (47° N., the latitude of the Loire, central Switzerland or the Tirol) and to Oregon, is not fully satisfactory; and "Hemerocallis (Calif.)" for a well-known Eurasian genus, which is found in California only in gardens, is inexplicable unless one supposes it to have arisen through confusion with the western American *Hesperocallis*, but in the same paragraph Hutchinson correctly assigns *Hesperocallis* to California. Every one may make occasional slips but, when such misstatements are numerous and put forward with seeming finality, they increase the reader's scepticism regarding the deductions drawn and the fundamental changes of classification proposed. The natural caution about following Hutchinson in removing *Allium* and its allies from the *Liliaceae* and transferring them to the *Amaryllidaceae* or in severing the *Resedaceae* from the *Papaverales* and placing them in the *Violales* seems justified. In some cases, however, Hutchinson puts a single genus into two groups: thus *Kyllinga* (p. 196) is placed in the tribe *Rynchosporeae* and also in the tribe *Cypereae*. If that is possible, why should not a genus belong to two families and a family to two orders?

barium also from Lee Co., Florida (*J. P. Standley*, no. 141). Its abundance about Back Bay indicates that in the Carolinas and Georgia it has presumably been confused with *T. angustifolia*.

Sagittaria falcata Pursh. Salt to brackish or fresh marshes and river-margins, seen at Munden and on the marshes of North Landing River and its tributary, Blackwater River: Munden, no. 3625.

This is doubtless the plant listed by Kearney as *S. lancifolia* L. *S. falcata* was long confused with the latter species of tropical and subtropical America; it has the bracts of the inflorescence short, blunt and coarsely papillate, whereas the bracts of *S. lancifolia* (known in Florida) are lance-attenuate, much-prolonged and smooth.

Sagittaria **Weatherbiana**, sp. nov. (tab. 385 et tab. 386, fig. 1), planta 4–9 dm. alta; rhizomate breve et crasso, stolonibus elongatis apice tuberosis; foliis exterioribus membranaceis lineari-oblongis obtusis vel subacutis 1.5–2.5 cm. latis; foliis interioribus longe petiolatis, petiolo erecto 2–4.5 dm. longo crasso, basi dilatato-amplectante; limbo lanceolato vel oblanceolato vel elliptico utrinque acuminato 1.2–2.5 dm. longo 2.5–7.5 cm. lato submembranaceo perviridi 5–7-nervo; scapo erecto 3–6 dm. alto; inflorescentiis monoicis vel dioecis verticellis 3–6 remotis, flores longe et graciliter pedicellatis, pedicellis 2.5–6.5 cm. longis ante anthesin adscendentibus postea divaricatis; bracteis 3 scariosis ovato-acuminatis basi coalitis 5–10 mm. longis; sepalis ovatis 6–9 mm. longis, post anthesin reflexis; petalis obovatis lacteis 1–1.5 cm. longis; staminibus 12–18, filamentis complanatis basi dilatatis pubescentibus, antheris lineari-oblongis fere basifixis 2–2.5 mm. longis; carpellis maturis complanatis anguste et oblique cuneato-obovatis 2–2.5 mm. longis 1–1.5 mm. latis utrinque anguste alatis, alis tenuibus, parietibus costis 1–3 elongatis instructis vel ecostatis, stylo subulato vix 0.5 mm. longo.—Southeastern Virginia to eastern South Carolina. Virginia: in water of gum swamp south of North Landing, Norfolk Co., August 7, 1934, *Fernald & Long*, no. 3624, disintegrating material, distributed as *S. cycloptera* (J. G. Smith) Mohr; open pools in gum swamp north of Land of Promise (same region as above), May 7, 1935, in flower, *Fernald & Griscom*, no. 4297 (type in Gray Herb.); same station, June 18, 1935, in overripe fruit, *Fernald, Griscom & Long*, no. 4536. North Carolina: shallow water of roadside excavation, Washington, Beaufort Co., April 15, 1932, in flower, *Weatherby*, no. 6086, distributed as *S. lancifolia* L. South Carolina: marsh, Longwood Island, Waccamaw River, Horry Co., April 22, 1932, in flower, *Weatherby & Griscom*, no. 16,395, distributed as *S. lancifolia* L.

Sagittaria Weatherbiana has been confused, it will be noted, with both *S. cycloptera* and *S. lancifolia;* it is also somewhat allied to *S. graminea* Michx. and it superficially resembles *S. ambigua* J. G. Sm. From *S. graminea* with which, as well as with *S. cycloptera*, it shares dilated filaments, it differs in its greater size in all parts, *S. graminea* having narrower and long-acuminate phyllodia; slender-petioled inner or later leaves, with blades very rarely up to 1.5 dm. long and 3 cm. broad; pedicels at most 3 cm. long; bracts blunt and at most 6 mm. long; anthers (plate 386, fig. 2) ellipsoid or rounded and only 0.6–1 mm. long; achenes (plate 386, figs. 3–5) 1.5–2 mm. long. *S. graminea* flowers in the North (Newfoundland, southern Labrador and Ontario thence into the northernmost States) from late June to September, in the southern part of its range (Delaware, District of Columbia, southern Indiana, Missouri and Texas) from late May to August; *S. Weatherbiana* is one of the earliest species, flowering in April and early May, its mature achenes essentially all dropped by mid-June.

S. Weatherbiana in foliage closely simulates *S. ambigua*. That species of Missouri, Kansas and Oklahoma, however, has lance-attenuate, very slender-tipped and papillate bracts 1–1.5 cm. long and essentially free to the base; pedicels only 1.5–3.5 cm. long; filaments (plate 386, fig. 6) filiform-subulate (not dilated below); and shorter and much more rounded achenes (plate 386, fig. 7). *S. Weatherbiana* only superficially resembles *S. ambigua*.

The newly proposed species, when Mr. Long and I first collected it, was placed provisionally in *S. cycloptera*, awaiting adequate flowering and fruiting material. The differentiating characters are many: *S. cycloptera* has an elongate rhizome; narrow (3–12 mm. wide) and long-attenuate phyllodia; slender-petioled later leaves, with linear-lanceolate blades; pedicels 1–3 cm. long; anthers (plate 386, fig. 8) 0.8–1.2 mm. long; and achenes (plate 386, figs. 9 and 10) with very conspicuously developed dorsal keel.

From *Sagittaria lancifolia* the more northern *S. Weatherbiana* differs in many characters. *S. lancifolia*, a tropical American species, unknown north of Florida, has coriaceous blades, firm lanceolate bracts up to 3 cm. long; pistillate pedicels shorter than to about twice as long as their subtending bracts; filaments (plate 386, fig. 11) slender (not dilated); achenes (plate 386, figs. 12 and 13) 2.5–3 mm. long, with thickened dorsal keel; a species far removed from *S. Weatherbiana*.

The northeastern representative of *Sagittaria lancifolia* is *S. falcata* Pursh, extending north to Delaware and Maryland. Like *S. lancifolia* it has firm or coriaceous pale-green leaves, quite different from the dark-green and submembranaceous blades of *S. Weatherbiana*.

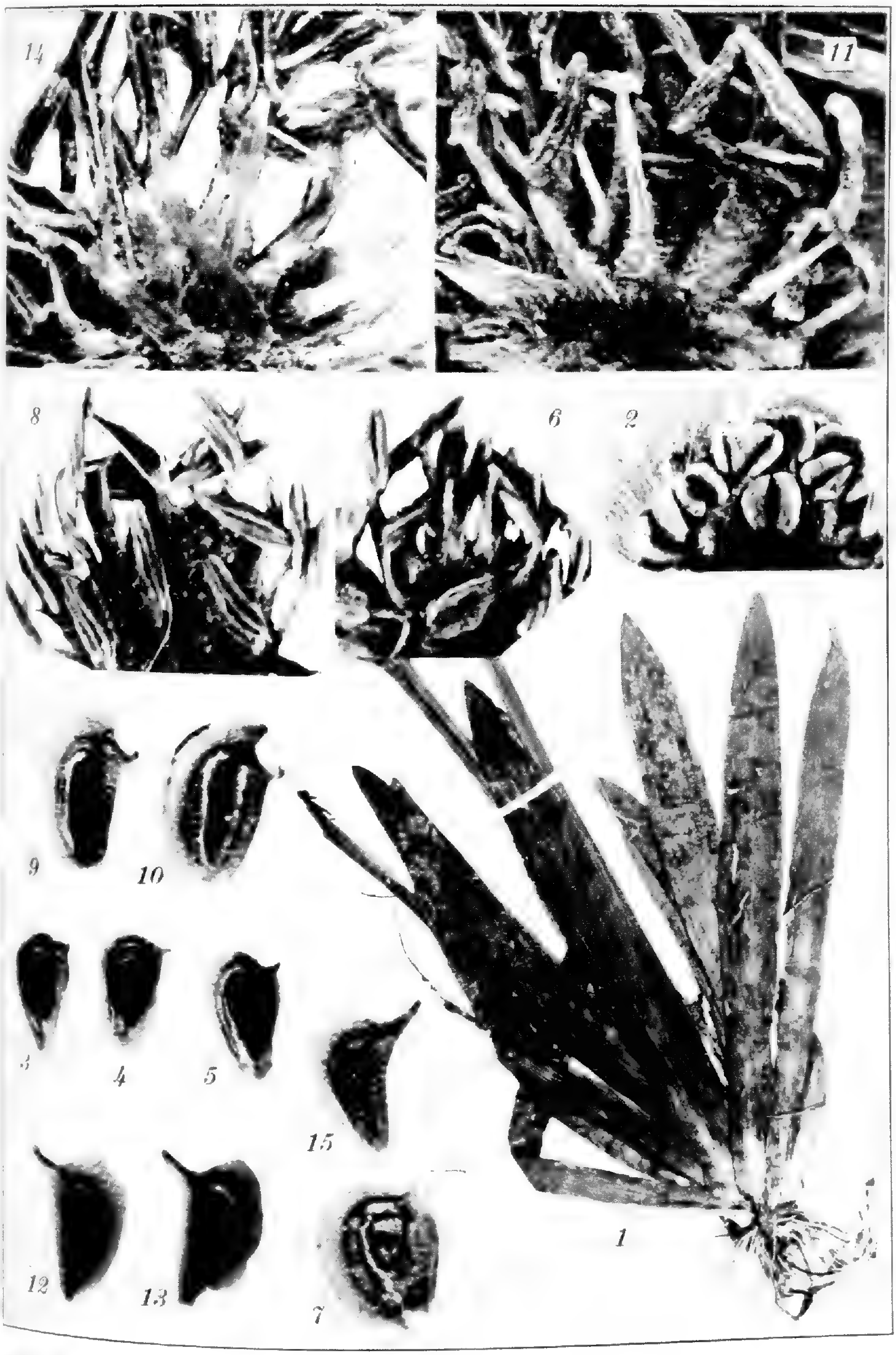


Photo. E. C. Ogden.

SAGITTARIA WEATHERBIANA: FIG. 1, phyllodia, × 5/12.
S. GRAMINEA: FIG. 2, anthers, × 10; FIGS. 3–5, achenes, × 10.
S. AMBIGUA: FIG. 6, stamens, × 10; FIG. 7, achene, × 10.
S. CYCLOPTERA: FIG. 8, stamens × 10; FIGS. 9 and 10, achenes, × 10.
S. LANCIFOLIA: FIG. 11, stamens, × 10; FIGS. 12 and 13, achenes, × 10.
S. FALCATA: FIG. 14, stamens, × 10; FIG. 15, achene, × 10.

Photo. E. C. Ogden.

ELEOCHARIS AMBIGENS: FIG. 1, plant, × 2/5; FIGS. 2 and 3, spikelets, × 4; FIGS. 4 and 5, summit of sheath, × 10; FIG. 6, achene, × 10; FIG. 7, achene, × 25; FIG. 8, surface of achene, × 50.

E. UNIGLUMIS: FIG. 9, spikelet, × 4; FIG. 10, summit of sheath, × 10; FIG. 11, achene, × 10.

E. HALOPHILA: FIG. 12, spikelet, × 4; FIG. 13, summit of sheath, × 10; FIG. 14, achene, × 10.

Its bracts and sepals are obtuse and strongly papillose; its pistillate pedicels are only 0.5–2.5 cm. long; its filaments (PLATE 386, FIG. 14) are slender and longer than the anthers; and its falcate achenes (PLATE 386, FIG. 15) are only 0.7–1 mm. wide and tapering to erect beaks. *S. falcata* is a late-flowering species of brackish to fresh river- and pond-borders and marshes. In southeastern Virginia, the Carolinas and Georgia it flowers from July to September. In Princess Anne County, the day (June 18) we collected the deep-green *S. Weatherbiana* with its achenes mostly fallen, the pale-leaved *S. falcata*, at the margins of Blackwater and North Landing Rivers, had not developed sufficiently to show young flower-buds.

PUCCINELLIA FASCICULATA (Torr.) Bickn. Upper border of salt marsh, Wachapreague, Accomac Co., no. 3629.

Apparently an extension southward from Delaware.

GLYCERIA SEPTENTRIONALIS Hitchc. Shallow water of swampy woods throughout, flowering in May (or earlier), essentially unrecognizable in mid-June: south of North Landing, no. 3630 and *F. & G.*, no. 4308; Little Creek, *F. & G.*, no. 4307; near Cornland, *F. & G.*, no. 4309.

The profusion of *Glyceria septentrionalis* in the coastal-plain swamps of southeasternmost Virginia and its absence northeast of Massachusetts, suggests that is is a subaustral, rather than a boreal species.

TRIPLASIS PURPUREA (Walt.) Chapm. Sand dunes, Cape Henry, *F. & G.*, no. 2712.

CALAMAGROSTIS CINNOIDES (Muhl.) Bart. Frequent from the northeastern corner of the Dismal Swamp across the Green Sea: wet peaty clearings in woods of *Pinus serotina*, south of Grassfield, no. 3647.

POLYPOGON MONSPELIENSIS (L.) Desf. Fresh to brackish or saline swales, pond-margins and shores, with strictly indigenous associates and looking as native as they: Wachapreague, no. 3643; outlet of Rainey's Pond, Sand Bridge, no. 3644, *F. G. & L.*, no. 4550; Cedar Island, *F. G. & L.*, no. 4551.

The statements of habitat, "Waste places" and "Moist waste places," in our current manuals are most unsatisfactory for the plant of the Virginia coast, although on the coast northward to New England the plant has every appearance of a casual introduction.

SPOROBOLUS POIRETII R. & S. Roadsides, borders of fields and ditches, frequent: Little Creek, no. 3645; Knott's Island, no. 3646.

ARISTIDA OLIGANTHA Michx. Dry clay of open woods and thickets, north of Blackwater River, no. 3641.

A. LONGESPICA Poir. Dry open soil or open woods: north of Blackwater River, no. 3642; Cedar Hill, *F. & G.*, no. 2718.

Leptochloa filiformis (Lam.) Beauv. Border of brackish marsh near Kempsville, *F. & G.*, no. 2709.

Spartina cynosuroides (L.) Roth. Salt or brackish marshes, frequent: Kempsville, *F. & G.*, no. 2710.

Gymnopogon brevifolius Trin. Occasional in Princess Anne Co.: border of ditch, Macon's Corner, *F. & G.*, no. 2708; damp sandy and peaty depressions back of dunes, Rifle Range, south of Rudy Inlet, no. 3650.

Axonopus furcatus (Flügge) Hitchc. Princess Anne Co.: damp sandy and peaty depressions back of the dunes, Rifle Range, south of Rudy Inlet, no. 3663; dry open clay lands and thickets, Virginia Beach, no. 3664.

Paspalum laeve Michx., var. pilosum Scribn. (*P. longipilum* Nash). Pine woods near Macon's Corner, Princess Anne Co., *F. & G.*, no. 2730.

P. laeve, var. circulare (Nash) W. Stone (*P. circulare* Nash). Ditch by brackish marsh of North Landing River, Pungo Ferry, *F. & G.*, no. 2728.

P. setaceum Michx. Dry thicket near Cedar Hill, *F. & G.*, no. 2729.

P. setaceum Michx., var. supinum (Bosc) Trin. (*P. supinum* Bosc). Wet peaty depressions in sandy pineland, The Desert, Cape Henry, no. 3659; sandy woods, northern end of Knott's Island, Princess Anne Co., no. 3660.

A slight extension northward, from North Carolina. *Paspalum supinum* Bosc, like *P. longepedunculatum* LeConte, is surely too confluent with *P. setaceum* for specific recognition. By treating them as definite species taxonomic values are debased and the clarity of true species, of which there is an abundance, is obscured. *P. longepedunculatum* should stand, it seems to me, as *P. setaceum*, var. *longepedunculatum* (LeConte) Wood.

P. ciliatifolium Michx. Wet, peaty clearings in woods of *Pinus serotina*, south of Grassfield, no. 3658.

Panicum anceps Michx., var. rhizomatum (Hitchc. & Chase) Fern. (*P. rhizomatum* Hitchc. & Chase). Dry pinelands, Cape Henry, *F. & G.*, no. 2741.

P. agrostoides Spreng., var. condensum (Nash) Fern. (*P. condensum* Nash). Border of brackish marsh of North Landing River, Pungo Ferry, *F. & G.*, no. 2738.

P. aciculare Desv. Damp sands and peats or sandy woods, Princess Anne Co.: Cape Henry, no. 3693, *F. & G.*, no. 2748; Rifle Range, no. 3694; Sand Bridge, *F. G. & L.*, no. 4537.

P. angustifolium Ell. Dry or moist woods, common in Princess Anne Co.: Little Neck, no. 3695; Virginia Beach, no. 3697.

P. roanokense Ashe. Swales and damp sands, Rifle Range, south of Rudy Inlet, nos. 3667, 3668, 3675; boggy swale by Northwest River, Northwest, *F. G. & L.*, no. 4538.

P. lucidum Ashe. Wet peaty clearings in woods of *Pinus serotina*, south of Grassfield, nos. 3670–3672; swampy or inundated woods, north of Blackwater River, no. 3673.

P. lanuginosum Ell. Frequent in swampy woods and wet peat: north of Blackwater River, no. 3680; Princess Anne Courthouse, *F. & G.*, no. 2755.

P. lanuginosum, var. septentrionale Fern. Swales back of the dunes, Rifle Range, south of Rudy Inlet, no. 3681.

P. villosissimum Nash. Occasional in Princess Anne Co.: damp sandy and peaty depressions back of the dunes, Rifle Range, no. 2699, *F. G. & L.*, no. 4543; dry mixed woods, Little Neck, no. 3700.

P. Commonsianum Ashe, var. Addisonii (Nash) W. Stone (*P. Addisonii* Nash). Damp sandy peats back of the dunes, Rifle Range, no. 3698; dry pine woods, Macon's Corner, Princess Anne Co., *F. & G.*, no. 2757.

P. columbianum Scribn. Sandy borders of gum swamps in The Desert, Cape Henry, no. 3701.

P. sphaerocarpon Ell., var. inflatum (Scribn. & Sm.) Hitchc. Depressions in clay fields, Rosemont, no. 3676.

P. polyanthes Schultes. Frequent in peaty and sandy woods, thickets and clearings, both counties: south of Grassfield, no. 3677.

P. ensifolium Baldw. Damp sandy and peaty depressions back of the dunes, Rifle Range, south of Rudy Inlet, nos. 3682, 3683, *F. G. & L.*, no. 4539.

P. Boscii Poir., var. molle (Vasey) Hitchc. & Chase. Dry, mixed woods, Little Neck, no. 3689.

Tripsacum dactyloides L. Frequent and conspicuous in dry fields and on roadsides, Princess Anne Co.: Munden, no. 3666.

Cyperus rivularis Kunth. Brackish marsh of North Landing River, Pungo Ferry, *F. & G.*, no. 2796.

C. sabulosus Mart. & Schrad. Frequent in damp soils, Princess Anne Co.: Kempsville, *F. & G.*, no. 2782; Rosemont, no. 3712; outlet of Rainey's Pond, no. 3713; Knott's Island, no. 3711.

C. compressus L. Occasional: sandy roadside, North Landing, *F. & G.*, no. 2794; depressions in clay field, Rosemont, no. 3708; sandy woods, Knott's Island, no. 3707.

C. difformis L. Virginia: in clay of marsh bordering Owl Creek, Virginia Beach, no. 3710.

Cyperus difformis is a species of wide dispersal in the Old World tropics of Asia, Africa, Australia and the Pacific Islands. In America it seems not to have been noted except in Mexico, where it is local, and in California, where it has recently appeared in rice-fields. It abounds in the clay ditches south of the small brackish pond of Owl Creek, growing in company with the typical plants of such a habitat, where it might be indigenous or with equal probability a recent introduction. It may be another of the recent introductions into our flora from the warm Far East, like *Cyperus Iria, C. amuricus* Max.[1] and *Polygonum caespitosum* Blume, var. *longisetum* (De Bruyn) A. N. Steward.[2] It is most probable that these oriental weeds have come in in rice-straw used as packing.

C. Haspan L. Local: inundated swales back of the dunes, south of False Cape, no. 3733.

C. Halei Torr. Silts near outlet of Rainey's Pond, Sand Bridge, no. 3719.

First north of Florida; leaf-margins very harsh.

C. lancastriensis Porter. Border of woods and in ditches, Little Neck, nos. 3735 and 3736.

C. retrofractus (L.) Torr. Dry pinelands, Cape Henry, no. 3734, *F. & G.*, no. 2787.

Kyllinga pumila Michx. Frequent in Princess Anne Co.: wet peaty depressions in sandy pineland, The Desert, Cape Henry, no. 3741; damp sand and clay back of the ponds, Dam Neck, no. 3742.

Eleocharis quadrangulata. In 1905 I pointed out[3] that the very distinct species with sharply quadrangular culms, *Eleocharis quadrangulata* (Michx.) R. & S., Syst. ii. 155 (1817), is quite unlike the tropical *E. mutata* (L.) R. & S., with which it had been confused. At that time I was familiar with *E. quadrangulata* chiefly at its northeasternmost station, Lake Waban at Wellesley, Massachusetts. Mr. Long and I saw *E. quadrangulata* several times in Princess Anne County and twice collected it and he, Mr. Griscom and I, in 1935, saw it in abundance and made one collection. Our material and all other from Princess Anne County and all I have seen from South Carolina, North Carolina, Delaware, and Cape May, New Jersey, agrees in being more slender and averaging smaller in all parts than the plant of the northern and inland states; but material from Savannah, Georgia is like the northern and inland plant. In the more slender plant the purple upper sheath at the base of the culm is tubular to within 10 to 5 mm. of the tip and it tardily ruptures. In the coarser plant the free tip is usually 4–6 cm. long, sometimes 8 cm., and the sheath so promptly ruptures that the free tip appears even longer.

Scirpus quadrangulatus Michx. Fl. Bor.-Am. i. 30 (1803), the type of *Eleocharis quadrangulata*, came from South Carolina and a photograph of the type most kindly sent by Professor Humbert of the Muséum National d'Histoire Naturelle at Paris and another sent by

[1] See Fern. & Grisc. Rhodora, xxxvii. 148 (1935).
[2] See Blake, Rhodora, xxxiv. 146, 147 (1932).
[3] Rhodora, xxvii. 38, t. 149, figs. 1–4 (1905).

Rev. Hugh O'Neill of the Catholic University of America show it to be the slender extreme of the southern coastal plain. I am accordingly differentiating two varieties, as follows:

ELEOCHARIS QUADRANGULATA (Michx.) R. & S., var. **typica.** *Scirpus quadrangulatus* Michx. Fl. Bor.-Am. i. 30 (1803). *E. quadrangulata* (Michx.) R. & S. Syst. ii. 155 (1817). Culms 3–9 dm. high, 1.5–4 mm. thick; upper basal sheath with free tip 0.5–1 cm. long; spikelet 1.5–4 cm. long; achenes 2–2.5 mm. long, 1.4–1.8 mm. broad.—Pools of coastal plain, South Carolina to Cape May, New Jersey.

Var. **crassior**, var. nov., culmis 6–12 dm. altis, 3–5.5 mm. crassis; apice libero vaginae 1.5–8 cm. longo; spiculis ad 6 cm. longis; achaeniis 2.2–3 mm. longis 1.6–2 mm. latis.—Georgia to Texas, locally north to Massachusetts, Connecticut, New York, southern Ontario, Michigan, Wisconsin, Missouri and Oklahoma. TYPE: in 3–8 dm. of water, Waban Lake, Wellesley, Massachusetts, October 3, 1908, *Fernald & Wiegand* in Pl. Exsicc. Gray. no. 133 (in Gray Herb.).

It is most probable that var. *crassior* is *Scirpus marginatus* Muhl., Gram. 28 (1817), which, on account of the earlier *S. marginatus* Thunb., was renamed *S. albomarginatus* R. & S. Mant. ii. 74 (1824). No material of Muhlenberg's plant can be found at Philadelphia; consequently a new type is selected for the coarse variety, for which the name assigned by Roemer & Schultes would be inappropriate.

E. ROSTELLATA Torr. Brackish marsh, Lynnhaven, no. 3760.

E. ALBIDA Torr. Local: inundated swales back of the dunes, south of False Cape, no. 3767, *F. G. & L.*, no. 4565.

E. LINDHEIMERI (Clarke) Svenson, RHODORA, xxxi. 199 (1929). Forming dense turf on open wet sand bordering an inundated swale back of the dunes, south of False Cape, Princess Anne Co., no. 3772, also *F. G. & L.*, no. 4572.

The first collection on the coastal plain from east of Texas and Oklahoma. Our material is quite like the type collection (*Lindheimer*, no. 315) but a little stouter. On the wet sand near False Cape (on the Back Bay side) it forms a dense green carpet, like a lawn, promptly distinguished from the taller and ubiquitous *E. flaccida* (Reichenb.) Urban by its spongy culms only up to 8 cm. high, its few-flowered flat spikelets, with narrow herbaceous and strongly striate scales, and its longitudinally ridged and trabeculate achenes.

E. MICROCARPA Torr. Wet peaty depressions in sandy pineland, The Desert, Cape Henry, no. 3761.

Quite typical, an extension north from South Carolina, though the only slightly different var. *filiculmis* Torr. (*E. Torreyana* Boeckl.), which is stiffer and with chestnut-brown and firmer scales, extends northward locally to eastern Connecticut. The futility of trying to keep *E. Torreyana* apart as a species is well shown by the treatment in Small's Manual. In the key, on page 160, *E. microcarpa* is given a whole call by itself: "Scape capillary: achene-body 0.5 mm. long," while *E. Torreyana* comes under "Scape filiform: achene-body over 0.5 mm. long," with a further division indicating that the achenes are "nearly 1 mm. long." The distinction between "capillary" and "filiform" is a bit erudite for a key, and in Small's fuller description of *E. microcarpa* (p. 164) the achenes have shown some instability, becoming "0.5 mm. long or a little longer." That is what they do in Nature. After comparing many of them I have given up trying to separate as species *E. Torreyana* from *E. microcarpa*. When Torrey first called attention to the two tendencies, he did not consider them separate species and even doubted whether they were varietally separable and he did not consider that capillary and filiform culms were fundamentally different. *E. microcarpa*, based on material from New Orleans, was fully described, with capillary culms 6–8 inches long; spikelets ("spikes") nearly 2 lines long; scales with "sides brownish-red"; and "*Nut* scarcely one-third of a line [0.7 mm.] long." His β. ? *filiculmis*, from New Jersey, had "*Culms* . . . . capillary or filiform, . . . wiry, 3–4 inches high. *Spikes* more than two lines long. *Scales* dark chestnut-coloured." Torrey noted a slight difference in the shape of the achene (nut) in his specimens but it is one which quickly disappears upon examination of a large series of the two extremes. *E. Torreyana* Boeckeler was merely Torrey's unfortunately named *E. microcarpa*, var. ? *filiculmis* raised without indication of new characters to specific rank.

Eleocharis **ambigens**, sp. nov. (tab. 387, figs. 1–8), laxe stolonifera, rhizomate stolonibusque firmis purpureo-castaneis 1.5–2 mm. crassis; culmis subrigidis pallidis 2.5–6 dm. altis 0.8–1.5 mm. crassis in caespitibus parvis; vaginis artis basi purpurascentibus vel castaneis ad apicem oblique subtruncatis coriaceis; spicula lanceolata vel anguste ovoidea 4–9 mm. longa 2–3.5 mm. crassa, laxe pauciflora; squama inferiora spathiformi late ovata subcoriacea stramineo-grisea basi plerumque valde prolongata; squamis fertilis lanceolato-ovatis acutis vel subacutis pallide brunneis margine albido-hyalinis, imis mediisque 2–3 mm. longis; setis 2–3 brevissimis vel nullis; achaeniis ellipsoideo-obovoideis biconvexis stramineis deinde subcastaneis 1.2–1.7 mm. longis 1 mm. latis minute reticulatis; tuberculo depresso-deltoideo apiculato 0.2–0.5 mm. alto 0.5–0.7 mm. lato.—Pond-margins and marshes, Elizabeth Islands, Massachusetts to southeastern Virginia. Massachusetts: peaty margin of Sheep Pond, Cuttyhunk, August 11, 1927, *Fogg*, no. 2526. Rhode Island: damp sandy shore of Wash Pond, Block Island, August 22, 1913, *Fernald, Hunnewell & Long*, no. 8887. NEW JERSEY: toward the beach, Cape May Point, July 17, 1906, *S. S. Van Pelt;* Race Course Pond, Cape May Co., June 12, 1911, *O. H. Brown;* edge of salt marsh, Cape May, July 4, 1929, *Svenson*, no. 3162. VIRGINIA: marshes bordering ponds, Dam Neck, Princess Anne Co., July 30, 1934, *Fernald & Long*, no. 3765 (TYPE in Gray Herb.); same station, June 16, 1935, *Fernald, Griscom & Long*, no. 4567; swale bordering Muddy Creek, Princess Anne Co., June 19, 1935, *Fernald, Griscom & Long*, no. 4569; swales and pond-margin, outlet of Rainey's Pond, June 19, 1935, *Fernald, Griscom & Long*, no. 4570; swales back of the dunes, Sand Bridge, June 19, 1935, *Fernald, Griscom & Long*, no. 4571; boggy swale by Northwest River, near Northwest, June 18, 1935, *Fernald, Griscom & Long*, no. 4568.

Eleocharis ambigens has been distributed sometimes as *E. palustris* (L.) R. & S., sometimes as *E. Smallii* Britton, again as *E. uniglumis* (Link) Schultes. It is the puzzling form which influenced the late Miss Brackett and me to treat as a variety of *E. uniglumis* the plant of saline and brackish shores from the Gulf of St. Lawrence to Virginia, *E. uniglumis* var. *halophila* Fern. & Brackett, RHODORA, xxxi. 72, t. 183 (1929). All three species, *E. palustris, E. Smallii* and *E. uniglumis* (FIG. 9–11) have the sheaths herbaceous at the oblique summit and the achenes smooth or only obscurely pebbled; and the first two have 2 or 3 narrow basal scales. The spathiform single basal scale of *E. ambigens* allies it with *E. uniglumis,* but that boreal species (reaching its southern limit in eastern America on the mountains of Newfoundland) has a broader tubercle (FIG. 11) 0.6–1 mm. broad, its spikelets are usually twice as large and with purple to castaneous firm scales (FIG. 9), and its achene is not definitely reticulated.

With *Eleocharis ambigens* now cleared from the boreal *E. uniglumis,* the troublesome series which was thought to connect the latter with its var. *halophila* disappears and the latter stands out as the clearly marked species which Miss Brackett and I were considering it until the Block Island and Cape May plants came to our attention. Many specimens were labeled and distributed by us as *E. halophila* and that binomial can now be revived:

E. **halophila** (Fernald & Brackett) Fernald & Brackett in herb. *E. uniglumis*, var. *halophila* Fernald & Brackett, RHODORA, xxxi. 72, t. 183 (1929). FIGS. 12–14.

Eleocharis ambigens differs from *E. halophila* in the cartilaginous orifice of the sheath, paler, thinner and shorter scales (the reddish to castaneous firm and lustrous scales of *E. halophila* 3–5 mm. long).

more broadly obovoid or pyriform reticulate achene with lower and broader tubercle, the slender-conical to lanceolate tubercle of *E. halophila* being only 0.2–0.5 mm. broad at the bulbiform base. For comparison a sheath-orifice (FIG. 13), a spikelet (FIG. 12) and an achene (FIG. 14) from the type of *E. halophila* are shown in PLATE 387. The range of E. HALOPHILA was extended southward from Delaware by its discovery in VIRGINIA: wet sandy depressions, False Cape, June 20, 1935, *Fernald, Griscom & Long*, no. 4566.

E. SIMPLEX (Ell.) A. Dietr. Apparently now local: swampy and inundated woods, north of Blackwater River, no. 3764.

E. TUBERCULOSA (Michx.) R. & S. Common in damp peaty swales and depressions throughout the area; the following collected: south of Grassfield, no. 3762; Rifle Range, south of Rudy Inlet, no. 3763.

DICHROMENA COLORATA (L.) Hitchc. Local: inundated swales back of the dunes, south of False Cape, no. 3740, also *F. G. & L.*, no. 4573.

FIMBRISTYLIS PUBERULA (Michx.) Vahl, forma **pycnostachya**, f. nov. (TAB. 388, FIG. 3), spiculis valde confertis dense glomerulatis. TYPE: damp sandy flats back of the dunes, Rifle Range, south of Rudy Inlet, Princess Anne Co., Virginia, July 30, 1934, *Fernald & Long*, no. 3752 (in Gray Herb.). Also collected in inundated swales back of the dunes, south of False Cape, Princess Anne Co., no. 3753; and examined from Missouri and Oklahoma.

F. PUBERULA, forma **eucycla**, f. nov. (TAB. 388, FIG. 2), spiculis pedicellatis, obovoideis vel obovoideo-ellipsoideis apice valde rotundatis vel subtruncato-rotundatis. TYPE: swales back of the dunes, Rifle Range, south of Rudy Inlet, Princess Anne Co., Virginia, July 31, 1934, *Fernald & Long*, no. 3750 (in Gray Herb.). Also from the same locality, nos. 3747, 3748; and examined from Georgia (Tybee Island, *Harper*, no. 738; Cumberland Island, *Harper* no. 1544).

Typical *Fimbristylis puberula* (PLATE 388, FIGS. 1 and 4), as I understand it, has the spikelets narrowed at summit, either obtuse or subacute. It is of wide range, northward near the coast to Long Island and inland in the Mississippi drainage to Indiana, Illinois, Nebraska and Colorado. Some of the material of the interior has been separated as *F. interior* Britton, Ill. Fl. ed. 2, i. 320, fig. 785 (1913), because it has "Scales glabrous," whereas *F. puberula* was defined by Dr. Britton as having "Scales, at least the lower, pubescent or puberulent." *F. interior* was given a range from "Colorado and Nebraska to Texas." There are before me several sheets from Colorado, Nebraska and Kansas (as well as many from Oklahoma). The 3 sheets from Colorado all show, with a lens × 8, puberulent lower scales; the 2 from Kansas likewise show them, and 1 from

Photo. E. C. Ogden.

Fimbristylis puberula: fig. 4, umbel, × 1.
F. puberula, forma eucycla: figs. 1 and 2, plant, × 1.
F. puberula, forma pycnostachya: fig. 3, umbel (glomerule), × 1.

Photo. E. C. Ogden.

Fimbristylis Baldwiniana: inflorescences, × 1; spikelets, × 5; achenes × 10.

Nebraska has them puberulent, another apparently not. Conversely, along the Atlantic coast the puberulence is often most evasive and seen only on the very youngest spikelets, if at all; consequently, in sending out the collections of L. F. and Fannie R. Randolph from North Carolina, the specimens which were young enough to show some puberulence were called *F. puberula* (*Randolph & Randolph*, no. 1024), those which were older were called *F. interior* (*R. & R.* no. 540).

Fimbristylis puberula, when lacking the puberulence, can best be told from *F. castanea* (Michx.) Vahl (the *F. spadicea* of continental American authors), by growing in small soft tufts, with thin and soft leaf-sheaths and (when properly collected) showing slender rhizomes and stolons, which in hard soil are not often collected. *F. castanea* forms dense tussocks, has dark coriaceous sheaths and is nonstoloniferous.

F. CASTANEA (Michx.) Vahl. Forming dense tussocks at borders of salt or brackish marshes: Wachapreague, Accomac Co., no. 3743; Lynnhaven, no. 3744.

FIMBRISTYLIS BALDWINIANA (Schultes) Torr. (PLATE 389). The plant of southeastern Virginia is quite typical, but in studying it I have taken the opportunity to compare it with the recently proposed *F. Darlingtoniana* Pennell, Bartonia, xv. 30 (1933). The two, as maintained by Pennell, differ as follows:

Achene pale yellow, finely and sharply striate-sulcate, about 1 mm. long; scales pale brown, green-ridged, dull or slightly shining, as wide as long, acute or slightly mucronulate, slightly bowed, wholly appressed; spikelets several, on the widely spreading rays of the simple or once-compound umbel; stem usually 2–3.5 dm. tall. . . . . 1. *F. baldwiniana*

Achene silvery white, striate or slightly sulcate, slightly more turgid, about 1.25 mm. long; scales dark brown, green-ridged, lustrous, strongly bowed and with tips loosely ascending; spikelets 1 to 6, on the ascending rays of the nearly always simple umbel; stem usually 0.5–2.0 dm. tall. . . . . . 2. *F. darlingtoniana*

Fimbristylis Baldwiniana is maintained, rightly, for the plant of the Atlantic coastal plain, from Maryland to Florida and Texas. *F. Darlingtoniana* is supposed to be confined to "Serpentine Barrens of southeastern Pennsylvania, northeastern Delaware, and doubtless in adjacent Maryland." As illustrated by Pennell (his fig. 1) the achenes are quite different. In studying the material in the Gray Herbarium, including 11 sheets of *F. Darlingtoniana* from the serpentines of southeastern Pennsylvania and adjacent Delaware (two of them fine sheets from William Darlington himself) I find myself puzzled to keep this plant apart as a species. As a geographic variety it is hardly separable, too many plants of the southern sands and granitic gravels having castaneous scales (FIGS. 18, 19, 22, 23), several of them having quite as large (FIGS. 24, 25) and as pale achenes; and in southeastern material, although the usually smaller and grayer achenes are commonly rougher, it is not unusual to find them embarrassingly smoothish (FIGS. 8, 24, 31), while quite roughened achenes are frequent in the material of *F. Darlingtoniana* (FIGS. 12, 17, 30).

As to the "several spikelets" on "widely spreading rays" of the umbel in *F. Baldwiniana,* as opposed to the only 1–6 spikelets "on the ascending rays" in *F. Darlingtoniana,* it is easy to find plants of the South with only 1–6 spikelets (Hyattsville, Maryland, September 30, 1912, *Holm;* Bedford Co., Virginia, September 4, 1871, *A. H. Curtiss;* North Landing, Norfolk Co., Virginia, *Fernald & Griscom,* no. 2772; Rosemont, Princess Anne Co., Virginia, *Fernald & Long,* no. 3756 (FIG. 13); Burke Co., North Carolina, *M. A. Curtis;* Leslie, Georgia, *Harper,* no. 405; Athens, Georgia, *Harper,* no. 68 (FIG. 22); Rock Hill, Florida, *Harper,* no. 92; etc.). Conversely, one of the Darlington sheets from West Chester, Pennsylvania has as many as 10 spikelets, while *Pennell's* from Williamson School (FIG. 9) has 9 and the rays are as widely divergent as in much southern material. In order to check the characters reputed to separate two species I have asked Mr. Ogden to reproduce the inflorescences and the details of several specimens. These are shown in PLATE 389. I am unable to sort these photographs into two piles representing different species.

FIMBRISTYLIS AUTUMNALIS (L.) R. & S., var. **mucronulata** (Michx.), comb. nov. *Scirpus mucronulatus* Michx. Fl. Bor.-Am. i. 31 (1803). *F. mucronulata* (Michx.) Blake, RHODORA, xx. 25 (1918).

Blake showed in 1918 that the type of *Scirpus autumnalis* L., upon which *Fimbristylis autumnalis* rests, is the plant with lance-ovoid spikelets in comparatively little-branched inflorescences, which was described in 1855 as *F. Frankii* Steud. Syn. Pl. Cyp. 111 (1855) and for which the name *F. geminata* Kunth (1837) is in current use; while the extreme with more slender spikelets in often more compound inflorescences is *F. mucronulata* (Michx.) Blake, based on *Scirpus mucronulatus* Michaux, which came from the Carolinas. In their extremes the two are easily distinguished, but so many transitions occur (in shape and size of spikelet, color of scales, size and roughening of achenes and degree of branching) that I am at a loss to see anything but two strong divergencies of one specific type. Those to whom tendencies are equivalent to species will maintain them as specifically distinct. The identifications, as they come to the Gray Herbarium, indicate that no one has yet succeeded in stating differences between them which others can clearly interpret.

Scirpus Olneyi Gray. Abundant in saline or brackish marshes and even in fresh river-marshes, Princess Anne Co.: Lynnhaven, no. 3777; Blackwater River (fresh), *F. G. & L.*, no. 4574.

Rynchospora corniculata (Lam.) Gray. Local: in clay at border of swamp, Rosemont, no. 3784.

R. gracilenta Gray. Local in Norfolk Co.: wet, peaty clearings in woods of *Pinus serotina*, south of Grassfield, no. 3792.

Rynchospora gracilenta Gray, var. **diversifolia**, var. nov. (tab. 390, figs. 4–7), quam forma typica crassiore firmioreque ad 1 m. alto; foliis caulinis planis 1.5–2.5 mm. latis; cymis corymbiformibus terminalibus 1–1.5 cm. latis; spiculis 4–5.5 mm. longis; achaeniis 1.6–2 mm. longis, tuberculo 1.5–2.5 mm. longo.—Peats and wet sands of the Coastal Plain from Louisiana to Florida, north very locally to southern New Jersey. Type: swales back of the dunes, Rifle Range, south of Rudy Inlet, Virginia, July 31, 1934, *Fernald & Long*, no. 3796, in Gray Herb.

Typical *Rynchospora gracilenta*, very characteristic in its type-locality, the Pine Barrens of New Jersey, has the leaves all capillary or the cauline at most linear-involute and up to 1 mm. broad, the terminal cymes only 3–10 mm. broad, the spikelets 3–4 mm. long, achenes 1.2–1.5 mm. long and tubercle 0.8–1.4 mm. long. Its details are shown in figs. 1–3. Var. *diversifolia* has the leaves of the basal tufts capillary as in the typical form of the plant, but is quickly distinguished from it by its stiffer habit, broadish cauline leaves, and longer spikelets, fruits and tubercles. Several collections from Louisiana, Florida and Georgia belong to it and at least one from New Jersey: Quaker Bridge, August 18, 1866, *Diffenbaugh*.

Typical slender-leaved *Rynchospora gracilenta* was collected in wet, peaty clearings in woods of *Pinus serotina*, south of Grassfield, Norfolk Co., no. 3792.

Rynchospora glomerata (L.) Vahl. In 1918 Dr. S. F. Blake showed[1] that typical *R. glomerata* is the coarse southern plant which had been called *R. glomerata*, var. *paniculata* (Gray) Chapm., while the somewhat smaller plant, which extends northward to Nova Scotia, New Brunswick, New England, northern New York, southern Ontario and Wisconsin, he identified with *R. capitellata* (Michx.) Vahl. Dr. Blake clearly established, through typical specimens sent to European herbaria, the identity of the coarse southern plant; the

[1]Blake, Rhodora, xx. 25–28 (1918).

identity of the smaller northward-ranging plant was less finally settled. At that time Blake was quite satisfied that the two were distinct species, saying: "The more northern plant, which has passed as true *glomerata*, has an achene 1.5 mm. long (including the crustaceous 'perianth'-base, but excluding the style) and 0.8 mm. wide, while in the more southern var. *paniculata* the achene is 2 by 1.5 mm. and much more umbonate. In the southern plant, moreover, the spikelet is usually 1-fruited, in the northern plant 2–3-fruited, as long ago noted by Kunth (Enum. ii. 296 (1837)) in describing the southern form as *R. glomerata* var. *robustior*. This difference in size and shape of achenes, which runs with great constancy through a series of more than 115 collections of the two plants, in combination with other differences in size of plant, breadth of leaf, looseness of inflorescence, and number of achenes in the spikelet fully confirms the specific distinctness of the two plants."

Nevertheless, although the more northern plant can hardly be confused with the largest extreme of the more southern, two trips to southeastern Virginia where both grow, first in September, 1933 with Mr. Ludlow Griscom, then with Mr. Bayard Long in late July and early August, 1934, have led me to a close study of the group with the hope of finding the clear differentiations emphasized by Blake but not satisfactorily evident in the field. As a result of this study I am forced to the decision that Asa Gray's later treatment of *R. glomerata* as a variable species, including both the northern and the southern extremes, was better justified than his earlier and less experienced judgment, that the latter were distinct species.

From inflorescences of the largest and most branching of true *Rynchospora glomerata* I get achenes with variation in size much greater than found by Blake: a range of 1.7–2 mm. in length and of 0.8–1.5 mm. in breadth. In fact, I take the extreme breadth, 1.5 mm., from Blake's statement; I have measured none exceeding 1.4 mm. The tubercle in this large southern extreme varies from 1–1.8 mm. long. As to the 1-flowered spikelets, ordinarily they are so; but it is not difficult to find them with 2 flowers, for instance in an Arkansas specimen (Grand Prairie, *Harvey*, no. 13) which Blake has specially annotated as *R. glomerata*. It, like several other sheets of the latter, exhibits 2-flowered as well as 1-flowered spikelets.

In the northern plant, *Rynchospora capitellata* of Blake's treatment, I have taken achenes from the most northeastern material, from Nova Scotia, New Brunswick and New England. I find it difficult to get any to meet the stated specifications: 1.5 mm. long, 0.8 mm. wide. Instead, I find a variation of 1.5–1.8 mm. in length, of 0.8–1.2 mm. in breadth; while the tubercle ranges from 0.8–1.2 mm. long.

These measurements, it will be noted, all overlap. As a result I find it impossible, without further illumination, to retain *Rynchospora capitellata* as a good species. Its first available varietal name is *R. glomerata*, var. *minor* Britton, Trans. N. Y. Acad. Sci. xi. 87 (1892). At the same time (p. 88) Britton published *R. glomerata*, var. *leptocarpa* Chapm. for a plant of the southern Coastal Plain. The slight difference in the shape of the achene, the remote and few axillary cymes and the narrow leaves of the latter all appear sporadically in the North, but for the main series of the latter area the name var. *minor* is without question. Var. *leptocarpa*, although it seems to me unworthy special recognition, is maintained by Blake; and Small elevates it to specific rank, as *R. leptocarpa* (Chapm.) Small, Man. 181, 1503 (1933).

Throughout the genus the direction of the barbs or serratures on the bristles is very fickle, as it is in *Eleocharis* and *Scirpus*. From the same areas one can get retrorsely or upwardly barbed bristles or even those which are perfectly smooth. Such divergencies from the ordinary are most interesting but they do not constitute true varieties (as I use the term). As forms they are adequately and more satisfactorily covered. My own interpretation of *Rynchospora glomerata* is covered by the following key.

a. Culms stoutish, 0.5–2 m. high; leaves 3–7 mm. broad; inflorescence 0.3–1 m. long, its axillary peduncles freely forked; spikelets 5–6 mm. long, most often 1 (sometimes 2)-flowered; achenes 1.7–2 mm. long, 0.8–1.5 mm. broad; tubercle 1–1.8 mm. long . . . . Var. *typica*.
a. Culms rather slender, 0.1–1.5 m. high; leaves 0.5–4 mm. broad; inflorescence 0.2–6 dm. long, its axillary peduncles less forked or simple; spikelets 3–5 mm. long, usually 2–3-flowered; achenes 1.5–1.8 mm. long, 0.8–1.2 mm. broad; tubercle 0.8–1.2 mm. long . . . . *b*.
b. Bristles serrulate or barbed.
Bristles retrorsely barbed . . . . Var. *minor*.
Bristles upwardly barbed . . . . Var. *minor*, forma *controversa*.
b. Bristles smooth . . . . Var. *minor*, forma *discutiens*.

R. GLOMERATA (L.) Vahl, var. **typica**. *Schoenus glomeratus* L. Sp. Pl. i. 44 (1753). *R. glomerata* (L.) Vahl, Enum. ii. 234 (1805); Blake, RHODORA, xx. 26, fig. 1 (1918). *R. paniculata* Gray, Ann. Lyc. N. Y. iii. 211, t. vi. fig. 21 (1835), not Presl (1828). *R. glomerata*, var. *robustior* Kunth, Enum. ii. 296 (1837). *R. glomerata*, var. *paniculata* (Gray) Chapm. Fl. So. States, 528 (1860); Britton, Trans. N. Y. Acad. Sci. xi. 88—repr. 15 (1892).—Florida to Texas, north to Delaware, Maryland, Tennessee, Arkansas and Oklahoma.

Var. minor Britt. Trans. N. Y. Acad. Sci. xi. 88—repr. 15 (1892). *Schoenus capitellatus* Michx. Fl. Bor.-Am. i. 36 (1803), in part. *R. capitellata* (Michx.) Vahl, Enum. ii. 235 (1805); Blake, Rhodora, xx. 27 (1918). *R. glomerata* Gray, Ann. Lyc. N. Y. iii. 217, t. vi. fig. 29 (1835) and later authors up to 1918. *R. glomerata,* var. *leptocarpa* Chapm. in Britt. l. c. (1892), the slenderest state, of swampy woods and thickets. *R. capitellata,* var. *minor* (Britt.) Blake, Rhodora, xx. 28, fig. 2 (1918). *R. capitellata,* var. *leptocarpa* (Chapm.) Blake, l. c. fig. 5 (1918). *R. leptocarpa* (Chapm.) Small, Man. 181, 1503 (1933).—Florida to Texas, north to Nova Scotia, New Brunswick, northern New England, northern New York, southern Ontario and Wisconsin.

Var. minor, forma **controversa** (Blake), comb. nov. *R. capitellata,* var. *controversa* Blake, Rhodora, xx. 28, fig. 3 (1918). *R. Smallii* Britt. in Small, Fl. Se. U. S. 1321, 1327 (1903).—Scattered in the range of var. *minor,* New Jersey and eastern Pennsylvania to North Carolina.

It is significant of the overemphasis which has been placed on the fickle characters of the bristles (as to their barbing) that Britton should have treated *R. glomerata,* var. *discutiens* and *R. capillacea,* var. *leviseta* (both with smooth instead of retrorsely barbed bristles) as mere varieties or as unworthy recognition (Ill. Fl. ed. 2) and *R. cephalantha* Gray (*R. axillaris* Britt. as to plant, not *Schoenus axillaris* Lam.) with upwardly (instead of retrorsely) barbed bristles as apparently nonexistent, while *R. glomerata,* var. *minor* with the bristles upwardly barbed was treated as a distinct species.

In fact, *R. cephalantha* (pl. 391, figs. 2 and 3) has the bristles either upwardly or downwardly serrulate in the same colony. When he described this species Gray, Ann. Lyc. N. Y. iii. 219 (1835), said of it: "A most remarkable circumstance with regard to this species, and so far as my observation extends, peculiar to it, is the diversity in the direction of the hispidness of the bristles: even in different individuals from the same cluster some of the bristles are hispid upward and others downward."

As to var. *leptocarpa,* as already stated, I can find no character of sufficient definiteness to keep it apart. Plants of the southern Coastal Plain, wandering into swampy woods and thickets (instead of growing in the open habitats), become attenuated in all parts and paler and seem to be what Chapman originally had. To me they are merely "drawn" and narrow-leaved responses to unfavorable conditions.

Var. minor, forma **discutiens** (Clarke), comb. nov. *R. glomerata,* var. *discutiens* Clarke in Britt. Trans. N. Y. Acad. Sci. xi. 88 (1892). *R. capitellata,* var. *discutiens* (Clarke) Blake, Rhodora, xx. 28, fig. 4

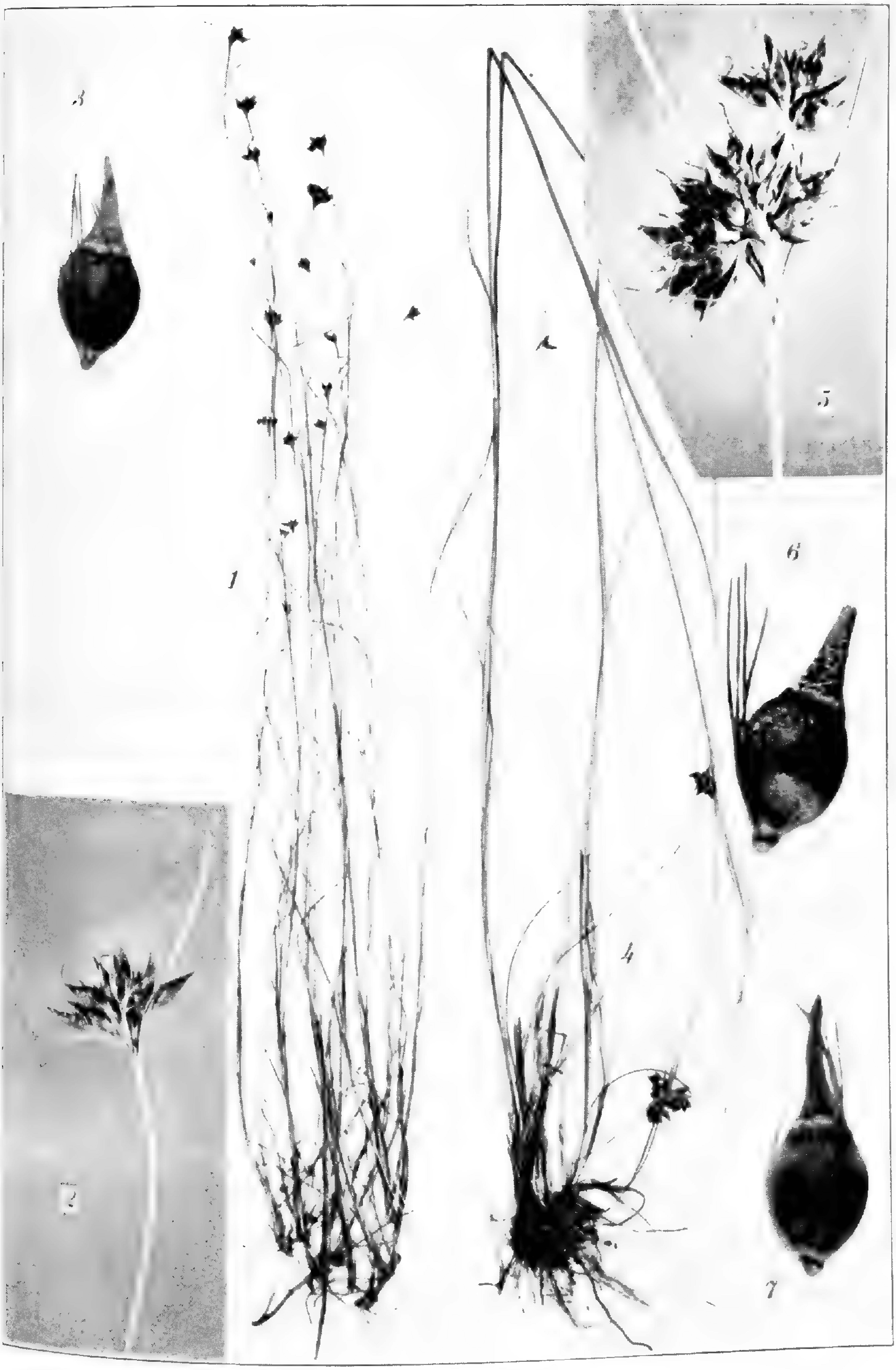


Photo. E. C. Ogden.

RYNCHOSPORA GRACILENTA: FIG. 1, plant, × ⅖; FIG. 2, inflorescence, × 2; FIG. 3 achene, × 10.

R. GRACILENTA, var. DIVERSIFOLIA: FIG. 4, plant, × ⅖ (TYPE); FIG. 5, inflorescence, × 2; FIGS. 6 and 7, achenes, × 10.

Photo. E. C. Ogden.

RYNCHOSPORA AXILLARIS: FIG. 1, TYPE, × ¾, from photograph supplied by Professor H. HUMBERT.

R. CEPHALANTHA: FIG. 2, inflorescence, × 1; FIG. 3, achene, × 10.

R. MICROCEPHALA: FIG. 4, inflorescence, × 1; FIG. 5, achene, × 10.

(1918).—Occasional, often abundant, in the range of typical var. *minor*, Nova Scotia to Wisconsin and North Carolina.

An explanation is necessary regarding *Rynchospora axillaris* (Lam.) Britt. Lamarck gave the briefest of diagnoses:

> 643. Schoenus *axillaris*.
> S. culmo triquetro folioso, corymbis minimis alternis axillaribus, spiculis confertis.
> E. Carolina. *D. Fraser.*

Kunth, whose *Rynchospora glomerata* included the smaller var. *minor*, i. e. *R. capitellata*, and who called the largest southern extreme (which Blake has shown to be true *R. glomerata*) *R. glomerata*, β. *robustior*, had no hesitation in placing *Schoenus axillaris* in the synonymy of his *R. glomerata:* "Schoenus axillaris *Lam. Ill.* 1. 137. (*fide herb. Willd.*)"— Kunth Enum. ii. 296 (1837); and he recognized *R. cephalantha* Gray, Ann. Lyc. N. Y. iii. 218 (1836), without doubt, as a distinct species (Kunth. l. c. 540). But Boeckeler, who had a very confused conception of American *Cyperaceae,* completely tangled matters. I do not venture to untangle his snarls, further than to point out that he took up *R. cephalantha* as a species and in its synonymy placed three wholly different species which no one knowing *Rynchospora* would merge with the almost unique *R. cephalantha* (pl. 391, figs. 2 and 3). Boeckeler's synonymy of his *R. cephalantha* was: "*R. glomerata* Kunth, 296 partim.—*R. distans* Willd. herb. no. 1141, f. 1.—*Schoenus axillaris* Lam. (fide specim. in Herb. Willd.)—*Schoenus capitellatus* Michx. l. c. 36 (v.s.)." That is certainly a catholic view of a species: as to *R. glomerata* see above; *R. distans* (Michx.) Vahl is a very different species of the southern coastal plain and the West Indies, with nearly filiform leaves and tiny inflorescences; *Schoenus capitellatus* is, as already sufficiently emphasized, the wide-ranging plant, extending northward into Canada, which has long passed (erroneously) as typical *R. glomerata;* and Kunth had explicitly stated that *S. axillaris* was the same as *S. capitellatus.* Nevertheless, notwithstanding Boeckeler's complete misunderstanding of *R. cephalantha,* the latter species was submerged by Britton wholly on the basis of Boeckeler's misinterpretation:

> "Rhynchospora axillaris (Lam.) (*Schoenus axillaris,* Lam., Encyc. i., 137 (1791); *R. cephalantha,* Gray, Ann. Lyc. N. Y. iii., 218 (1836). In taking up the name I am guided by Boeckeler in Linnaea, xxxvii., p. 572, who states that he saw a specimen named by Lamarck in Willdenow's Herbarium."—Britton, Bull. Torr. Bot. Cl. xv. 104 (1888).

Since all other species referred by Boeckeler to his *Rynchospora* *cephalantha* are surely not conspecific with it, it has seemed important to learn exactly what Lamarck had before him when he described *Schoenus axillaris*. This, happily, has been possible through the great kindness of Professor Humbert of the Muséum National d'Histoire Naturelle in Paris, who has supplied me with a photograph of Lamarck's type (our PL. 391, FIG. 1). The specimen is hopelessly young, a mere fragment from a very young inflorescence, but that it is not *R. cephalantha* (FIGS. 2 and 3) is perfectly apparent.

Personally I cannot match it with any degree of certainty. Its prolonged bracts, much longer than in any *mature* material known to me, and its wholly immature spikelets are so nearly impossible to match, that, in a genus with specific characters chiefly in the mature achenes it would be very unwise to attempt to displace a well defined specific name by the essentially unrecognizable *R. axillaris* (Lam.) Britton, as to type.

It thus seems clear that, in spite of the unfortunate synonymy given by Boeckeler and the faith in his judgment shown by Britton, *Rynchospora cephalantha* stands out as a species free from earlier nomenclatural entanglements. One later such alliance, however, needs dissolving. This is *R. axillaris*, var. *microcephala* Britton, Trans. N. Y. Acad. Sci. xi. 89—repr. 16 (1892) or *R. microcephala* Britton in Small, Fl. Se. U. S. 195 and 1327 (1903). This was originally defined merely as having "Heads smaller; spikelets only about 1 mm. wide" and was maintained as a small-headed extreme of *R. axillaris* in Britton & Brown, ed. 1, and by Robinson & Fernald; Small took it up in 1903 as a species, ascribing it to Britton, but in 1913 (Ill. Fl. ed. 2) Britton repudiated it, placing it, as *R. axillaris microcephala* in the synonymy of his *R. axillaris* and not mentioning *R. microcephala*. Britton's later view was apparently covered by the comment under *R. axillaris:* "Southern races have much smaller heads and smaller achenes than northern ones."

In geographic range I find little difference. Typical *Rynchospora cephalantha* (*R.* "*axillaris*" of Britton's treatment) extends from Mississippi to Florida, thence to Long Island; *R. microcephala* is also in Mississippi and Florida, but its northern range stops in New Jersey. But the two seem as distinct as any two paired species of *Rynchopora*. I make out the following diagnostic points which seem to indicate that they are not merely large and small variations of a single species but are quite separate entities.

R. CEPHALANTHA. Inflorescence occupying less than 1/3 the height of the plant, glomerules strictly terminal or in 1–3(–4) of the upper axils; spikelets 5–7 mm. long; achenes 2.2–2.6 mm. long, 1.4–1.6 mm. broad. Figs. 2 and 3.

R. microcephala. Inflorescence occupying 1/3–2/3 the height of the plant, glomerules in 2–6 of the upper axils; spikelets 3–4 mm. long; achenes 1.5–2 mm. long, 0.8–1.2 mm. broad. Figs. 4 and 5.

So far as I have been able to determine, the measurements of spikelets and achenes do not merge. An inflorescence of *R. cephalantha* × 1, is shown in fig. 2, of *R. microcephala,* × 1, in fig. 4; an achene of *R. cephalanatha,* × 10, in fig. 3, of *R. microcephala,* × 10, in fig. 4. The illustrations of *R. microcephala* are from *Fernald & Long,* no. 3785, from pine barrens south of Grassfield, Norfolk Co., Virginia.

R. fascicularis (Michx.) Vahl. Local: wet peaty depressions in sandy pineland, The Desert, Cape Henry, nos. 3789, 3790.

Apparently the first record from north of North Carolina.

R. Wrightiana Boeckl. Local: damp sandy and peaty depressions back of the dunes, Rifle Range, south of Rudy Inlet, no. 3797, also *F. G. & L.*, no. 4577, there associated with *R. rariflora.*

The first record of *R. Wrightiana* from north of North Carolina.

R. rariflora (Michx.) Ell. With the last, abundant and forming dense tussocks, no. 3791, also *F. G. & L.*, no. 4576.

R. cymosa Ell., var. globularis Chapm. Local: same locality as the two preceding, no. 3794, also *F. G. & L.*, no. 4575; typical R. cymosa in clay ditches bordering pine woods, Virginia Beach, no. 3795.

R. caduca Ell. Margin of thicket bordering inundated swale back of the dunes, south of False Cape, no. 3800; boggy swale by Northwest River, Northwest, *F. G. & L.*, no. 4578.

Slight extension northward, from North Carolina.

R. inexpansa (Michx.) Vahl. One of the common species of wet thickets and peats: Pungo Causeway, *F. & G.*, no. 2775; Blackwater River, no. 3799; Dam Neck, no. 3798.

Spikelets often altered into finely echinate spherical galls.

Cladium jamaicensis Crantz. Local: border of inundated woods north of Blackwater River, no. 3801.

Although already known from southeastern Virginia, the giant Saw Grass is not common there. The only place we saw it was slightly north of the Blackwater in the flooded woods bordering North Landing River, where it makes a characteristic growth.

Scleria setacea Poir. Damp sandy and peaty depressions back of the dunes, Rifle Range, south of Rudy Inlet, no. 3803.

Carex Muhlenbergii Schkuhr. Apparently frequent in woods:

Cape Henry, nos. 3816, 3818, also *F. & G.*, no. 2781; Little Neck, no. 3817.

Taller, less cespitose and with more prolonged rhizome than much of the New England plant.

C. abscondita Mackenz. Very common in woods, either wet or dry: Blackwater River, no. 3808; Little Creek, *F. & G.*, no. 4333; Little Neck, *F. G. & L.*, nos. 4593, 4594; Great Neck, *F. & G.*, nos. 4334, 4335.

Our plant is typical *C. abscondita* (*C. ptychocarpa* Steud., not Link). Mackenzie treats the largest extreme from Florida as a distinct species, his *C. magnifolia*, and separates it from *C. abscondita* by its having leaves "1.5–3.5 dm. long; perigynium 4–4.5 mm. long, the sides 2 mm. wide, the beak 1 mm. long,"[1] whereas *C.. abscondita* is characterized by shorter leaves, "perigynium 2.5–3.5 mm. long, the sides 1.5 mm. wide, essentially beakless." As a large extreme *C. magnifolia* is pronounced, but those who wish some morphological character for a species will treat it as a variety of *C. abscondita.* Chapman, who first described it, called it a variety (of *C. digitalis*) and Bailey treated it as a variety of *C. ptychocarpa.* Plenty of specimens from the northeastern limits of *C. abscondita* have leaves 3.5 dm. long (Purgatory Swamp, Norfolk Co., Mass., many collections) and at its northwestern limit (in Indiana) it often has perigynia 4 mm. long, while material from Hampton, Virginia, with perigynia up to 4 mm. long, has some of them scarcely, others very definitely beaked. As a variety the extreme plant of Florida is worthy recognition; as a species surely not. It is

C. abscondita Mackenz., var. **glauca** (Chapm.), n. comb. *C. digitalis*, var. *glauca* Chapm. Fl. So. U. S. 541 (1860). *C. ptychocarpa*, var. *macrophylla* Bailey, Mem. Torr. Bot. Cl. i. 48 (1889). *C. magnifolia* Mackenzie in Small, Fl. Se. U. S. ed. 2: 1375 (1913).

C. venusta Dew., var. minor Boeckl. (*C. oblita* Steud.). Local: wet peaty clearings in woods of *Pinus serotina*, south of Grassfield, no. 3806.

C. Walteriana Bailey, var. brevis Bailey. Swampy or inundated woods: Blackwater River, no. 3807; Cape Henry, *F. & G.*, no. 4345.

C. lupulina Muhl. Alluvial woods and thickets, and ditches, frequent: Rosemont, no. 3811; Virginia Beach, *F. G. & L.*, no. 4596.

Lemna perpusilla Torr. Fresh to brackish waters, Princess Anne Co.: Owl Creek, Virginia Beach, no. 3823.

L. valdiviana Phil. Fresh to brackish waters, Princess Anne Co.: Dam Neck, no. 3824, also *F. & G.*, no. 4353.

Spirodela polyrrhiza (L.) Schleid. Fresh to brackish waters,

[1] Mackenzie in Small, Man. 198 (1933).

Princess Anne Co.: False Cape, no. 3825, also *F. G. & L.*, no. 4598; Lake Joyce, *F. G. & L.*, no. 4599.

COMMELINA COMMUNIS L. Ditches and wet roadsides, common: Macon's Corner, Princess Anne Co., *F. & G.*, no. 2803.

C. HIRTELLA Vahl. Swampy woods and thickets back of the dunes, along Back Bay, False Cape, no. 3832.

HETERANTHERA RENIFORMIS R. & P. Swampy and inundated woods, north of Blackwater River, no. 3833.

JUNCUS EFFUSUS L., var. SOLUTUS Fern. & Wieg. Wet woods and thickets, comm on: Virginia Beach, no. 3847.

J. EFFUSUS, var. COSTULATUS Fern. Equally common: south of Grassfield, no. 3846.

J. DEBILIS Gray. Wet, peaty clearing in woods of *Pinus serotina*, south of Grassfield, no. 3838.

J. MEGACEPHALUS M. A. Curtis. Inundated swales back of the dunes, south of False Cape, no. 3841.

This station is very near if not exactly that of *R. M. Harper:* "damp hollow between beach and dunes, on coast of Princess Anne Co., about 2 miles n. of state line," July 23, 1918. Besides in the characters usually noted, *Juncus megacephalus* differs from *J. scirpoides* in the larger and more delicate bractlets of the flowers, in the more slender and pointed seeds and in the apparent lack of the whitish finger-like stolons which are so characteristic of the latter. Small (Man.) notes that it is calcicolous. Our material was from slightly brackish sand; and sheets in the Gray Herbarium, which indicate such details of habitat, give the following data: among lime-sinks, Lee Co., Georgia, *Harper*, no. 925; in brackish swamps, Florida, *Chapman;* wet sandy shore of Gulf, Apalachicola, with *Scirpus pungens* *Spartina patens, Spiranthes graminea, Samolus ebracteatus, Chapman* in Engelm. Herb. Junc. Bor.-Am. Norm., no. 68. Many labels indicate inconclusively ditches, dune-hollows, pine-barrens, prairies, etc.

J. ELLIOTTII Chapm. Damp sandy flats back of the dunes, Rifle Range, south of Rudy Inlet, no. 3837, also *F. G. & L.*, no. 4605.

Although apparently not recorded from north of North Carolina, *Juncus Elliottii* was collected in Elizabeth City County, VIRGINIA, in 1912: roadside ditches, Buckroe and border of marsh between Buckroe and Hampton, *B. L. Robinson*, nos. 316, 317. It has also been collected in one of the famous spots of DELAWARE: border of wet ditch, south of Ellendale, Sussex Co., June 23, 1909, *Bayard Long.* When carefully collected, *J. Elliottii* displays beautiful fusiform tuberous enlargements of many of the elongate roots.

UVULARIA PUBERULA Michx., var. **nitida** (Britton), comb nov. *Oakesia sessilifolia*, var. (?) *nitida* Britton, Trans. N. Y. Acad. Sci.

ix. 13 (1889). *U. sessilifolia nitida* (Britton) Morong, Mem. Torr. Bot. Cl. v. 111 (1894). *U. nitida* (Britton) Mackenz. Torreya, viii. 14 (1908). Plate 392, figs. 2, 3 and 6.

When Mackenzie separated *Uvularia nitida* as a species he correctly emphasized "the close relationship existing between the mountain bellwort (*U. puberula*) and our pine-barren plant" and he gave the distinctions which he found in tabular form, as follows:

	U. nitida	*U. puberula*
Capsule	Sessile, 17 mm. long	Sessile, 24 mm. long
Style	Slender, much exceeding the anthers	Thick, little exceeding the anthers
Leaves	Subcordate, very green on both sides, thinnish, not strongly reticulate-veined; margins minutely serrulate	Subcordate, very green on both sides, thick, strongly reticulate-veined; margins serrulate
Stem angles	Essentially smooth	Serrulate and puberulent

In further discussion Mackenzie said "From the above it may be noted that the differences between *U. nitida* and *U. sessilifolia* are very pronounced, while those between *U. nitida* and *U. puberula* are much more slight. This last-named species is variable, and incomplete specimens from the South, in the Columbia University herbarium, show a close approach to *U. nitida*. The species, however, as a rule, seem decidedly distinct, when represented by good specimens. The style character is apparently especially constant, although it may depend to some extent on the age of the flowers."

I have not had the advantage of knowing the plants in the field but specimens in the Gray Herbarium at once indicate that the capsules of *Uvularia puberula* are not merely "24 mm. long." On fruiting plants from the mountains of Virginia, West Virginia, North Carolina, South Carolina and Tennessee they range from 1.5 to 3.3 cm. long. One number, *Steele & Steele*, no. 286, in the Gray Herbarium, collected September 12th and consequently mature, consists of two fruiting plants, one with a capsule orthodox (2.4 cm. long), the other with it 1.6 cm. long (fig. 1), smaller than Mackenzie allowed for his *U. nitida*. As to the comparative length of style and anthers I find this situation. Material of *U. nitida* from South Lakewood, Ocean Co., New Jersey (*Mackenzie*, no. 4556) has the long style (fig. 2) as prescribed; but another New Jersey sheet, Tom's River, May 30, 1907, *Eggleston*, has the anthers much overtopping the common style (below its forking), as shown in fig. 3.

Turning to the Alleghenies of West Virginia, I find a sheet of perfectly good *Uvularia puberula*, from White Sulphur Springs, May 14

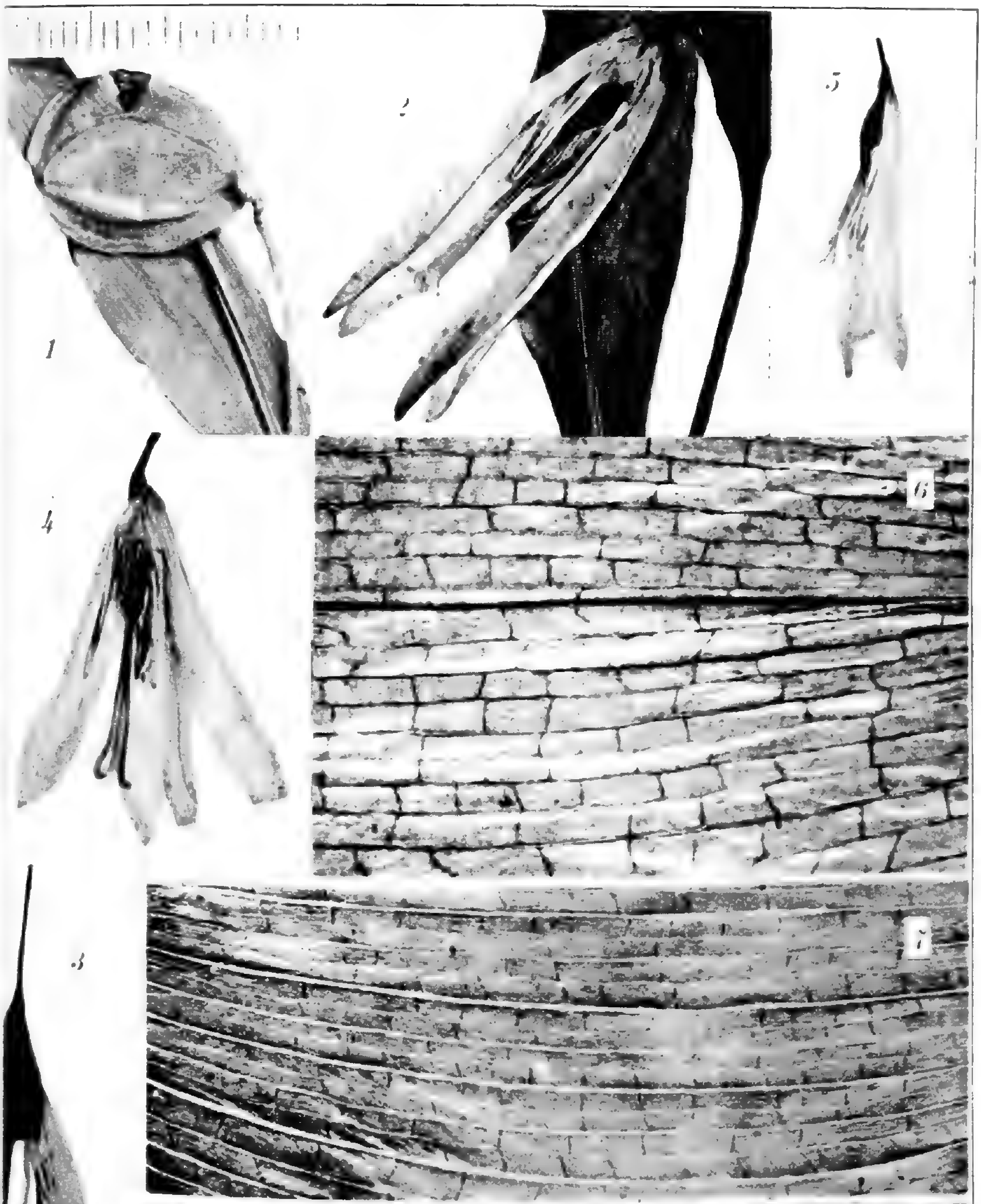


Photo E. C. Ogden.

UVULARIA PUBERULA: FIG. 1, exceptionally small fruit, × 1.8; FIG. 4, flower, showing long style, × 1.8; FIG. 5, flower, showing relatively long anthers, × 1.8; FIG. 7, lower surface of leaf, by reflected light, × 5; FIG. 8, reticulation of same leaf, by transmitted light, × 5.

U. PUBERULA, var. NITIDA: FIG. 2, flower, showing long style, × 1.8; FIG. 3, flower, showing relatively long anthers, × 1.8; FIG. 6, lower surface of leaf, × 5.

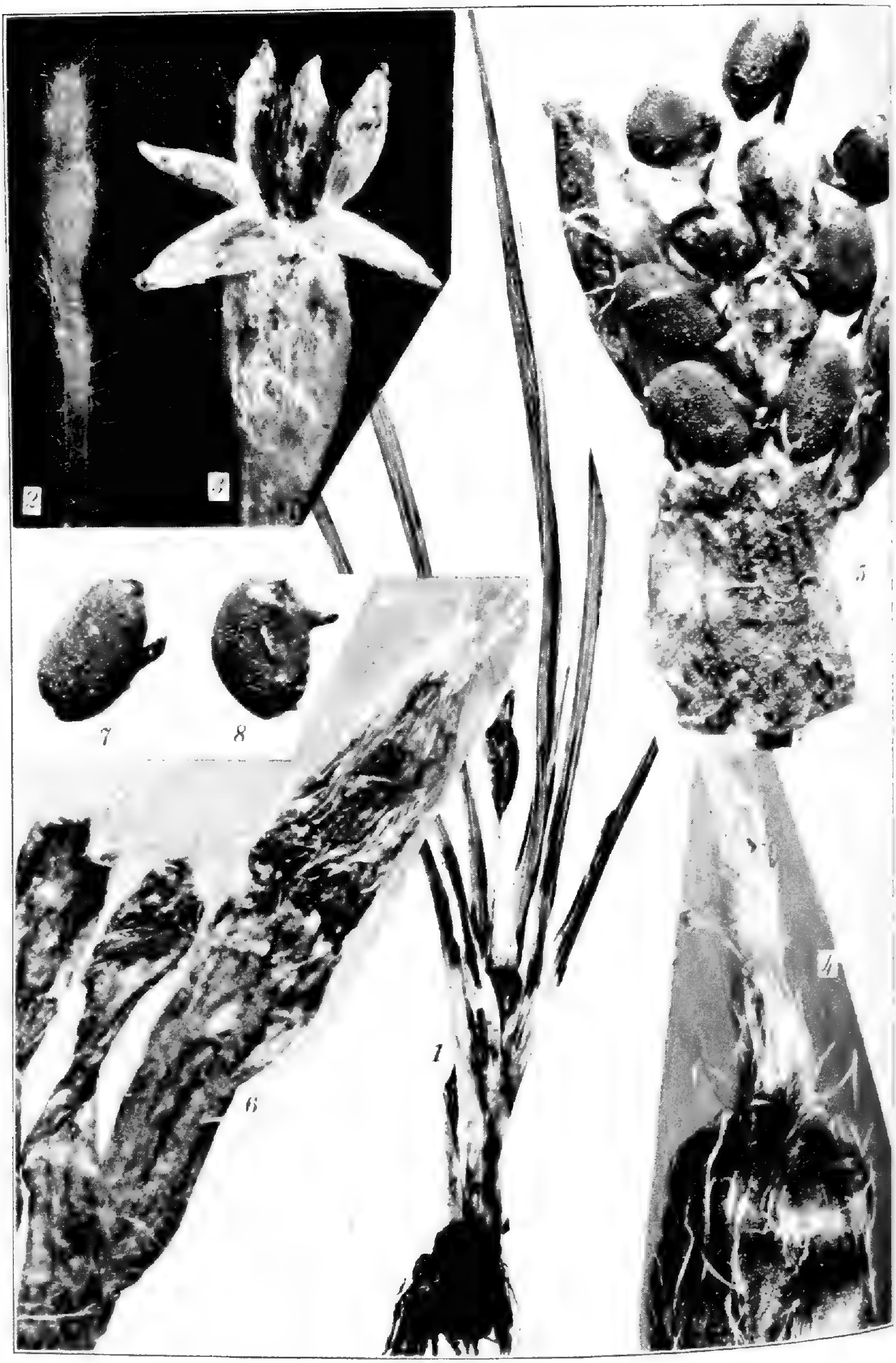


Photo. H. G. Fernald.

HYPOXIS LONGII: FIG. 1, fruiting plant, × 1; FIG. 2, flower, × 5; FIG. 3, flower, mechanically opened, × 10; FIG. 4, summit of capsule, × 10; FIG. 5, dehisced fruit, with seeds, × 10; FIG. 6, valves of capsule, × 10; FIGS. 7 and 8, seeds, × 12.

to 17, 1914, *Hunnewell,* with three flowering plants. I have removed the covering sepals from two flowers; one of them (FIG. 4) has the style elongate as in theoretical *U. nitida,* the other (FIG. 5) has the short style and long anthers of the Tom's River sheet of *U. nitida.* The styles, like the capsules, fail to give the sharp differentiation one would wish between *U. puberula* and *U. nitida.* In fact, it becomes evident that *U. puberula* (including *nitida*) exhibits heterostyly.

The leaves of *U. nitida* are, as Mackenzie maintained, thinner than in *U. puberula* and the reticulation is less prominent on the back; but it is of the same pattern. FIG. 6 shows the pattern of the reticulation, × 5, by reflected light of a leaf from some of Britton's original collection of his *Oakesia sessilifolia,* var. *nitida;* FIG. 7, the pattern, × 5, also by reflected light (showing shadows), from a leaf of *U. puberula* from Henderson Co., North Carolina (*Wiegand & Manning,* no. 856, as *U. sessilifolia*); and FIG. 8 is a portion of the same leaf photographed by transmitted light, × 5. The reticulate pattern is not sufficiently different for species.

Somewhere on the angles of the stems of *Uvularia puberula* one can usually find puberulence; the angles in *U. nitida* are glabrous. So far as I can make out this and the thinner leaf with reticulation less prominent beneath are the characters which separate *U. nitida.* I am, therefore, treating it as a variety of the coastal plain. The occurrences on the outer coastal plain of isolated colonies of Alleghenian types and the persistence in the Alleghenies of relic colonies of coastal plain types are so numerous that it is not unnatural that *Uvularia puberula* should have its coastal plain representative.

Kearney reported *U. puberula,* var. *nitida* (as *U. sessilifolia nitida*) from Suffolk, where many pine-barren species occur.[1]

UVULARIA SESSILIFOLIA L. Dry clay of open woods and thickets, north of Blackwater River, no. 3860.

SMILAX TAMNIFOLIA Michx. Wet woods near Great Bridge, no. 3856.

DIOSCOREA VILLOSA L. *D. paniculata* Michx.; Bartlett, U. S. Dept. Agric. Bur. Pl. Ind. Bull. no. 189: 15, map 3 (1910). Wet woods, south of Great Bridge, Norfolk Co., no. 3861; and seen in several other stations in Norfolk and Princess Anne Cos.

Bartlett rejected the name *Dioscorea villosa,* because he felt that the specific name was applied to the plant of northeastern America

[1] Fruiting material (*Fernald, Long & Fogg,* no. 4843) collected September 11, 1935 on a bank in dry woods at Kilby (slightly west of Suffolk) is typical Alleghenian *U. puberula,* with the firm leaves superficially reticulate beneath, the mature capsules 2.2–3.3 cm. long.

through confusion with some other and truly villous species. He admitted that the Clayton plant from Virginia (no. 94), which had been described by Gronovius and which Linnaeus had personally examined, had been accepted as the type. In view of the general confusion of citations given by Linnaeus for this, like a large proportion of his American species, the typification becomes highly abstract unless we accept the specimen which Linnaeus had had before him as final. In this case the typification had already been made and only confusion results by shifting it.

In his map and his citation of specimens, although admitting that Clayton's plant (presumably from southeastern Virginia) was what he chose to call *D. paniculata*, Bartlett gave no entries from south of Maryland. Our material, perfectly typical of the plant with pilose leaves, comes from within 10 miles of the North Carolina line, from the swampy area known as "The Green Sea," between Great Bridge and Benefit.

HYPOXIS **Longii**, sp. nov. (tab. 393), cormo cylindrico 0.7–1.2 cm. crasso; foliis linearibus firmis 1.5–3.5 dm. longis 2–4 mm. latis sparse villosis, vaginis membranaceis griseo-brunneis; pedunculis filiformibus pilosis anthesi vaginis inclusis deinde elongatis ad 6 cm. longis unifloris; bracteis 1–2 lineari-filiformibus 3–4 mm. longis caducis; floribus inclusis clausis; ovario 3–4 mm. longo clavato dense albido-piloso; sepalis lanceolatis 3 mm. longis 1 mm. latis dorso pallide viridibus longe piloso barbatisque, ventro albidis 5-nerviis; petalis albidis lanceolatis 2 mm. longis 0.5 mm. latis; antheris basifixis lanceolato-attenuatis, 0.8–1 mm. longis, basi cordatis; capsulis crasse clavatis 0.8–1 cm. longis 3–4 mm. latis sepalis albido-villosis conniventibus 4–5 mm. longis coronatis, apice mox circumscissis inferne valvis tribus dehiscentibus, sepalis caducis; seminibus crasse cylindricis vel anguste obovoideis 1.5–2 mm. longis diametro 0.8–1 mm. latere hilo rostrato conspicuo, testa olivaceo-nigrescentibus iridescentibus minute alveolatis.—VIRGINIA: damp peaty or sandy depressions back of the dunes, Rifle Range, south of Rudy Inlet, Princess Ann County, August 4, 1934, *Fernald & Long*, no. 3862 (TYPE in Gray Herb.; ISOTYPE in Herb. Phil. Acad.), June 16, 1935, *Fernald, Griscom & Long*, no. 4609.

Hypoxis Longii is, in several characters, the most extreme American species of the genus. Ordinarily the American species have the capsules quite indehiscent and permanently crowned by the connivent perianth-segments which form a beak. So generally is this the case that a botanist familiar with the Atlantic North American *H. hirsuta* (L.) Coville or the common tropical American *H. decumbens* L., is puzzled by the definition given in certain Old World treatments of *Hypoxis:* "In Hypoxis it [the fruit] is a capsule which slits off by circumscissile dehiscence below the operculum, and then sometimes, but not always, breaks up into three loculicidal valves"—Baker, *A Synopsis of Hypoxidaceae*, Journ. Linn. Soc. xvii. 97 (1878); and "Capsula . . . demum (an semper?) subapice circumscisse dehiscens"—Benth. & Hook. Gen. Pl. iii. 717 (1880). More consistent with our usual American experience is the definition of Hutchinson: "Fruit either a capsule and mostly crowned by the persistent perianth, opening by a circular slit or by short vertical slits near the top, or indehiscent and fleshy"—Hutchinson, Fam. Fl. Pl. ii. Monoc. 166 (1934).

When we first detected *Hypoxis Longii* the feature which attracted us was a remarkable membranous, white and 3-cleft structure (FIG. 6) which appeared like a 3-parted perianth, involucre or spathe. Soon we found some (FIG. 5) bearing the long central placenta covered with olive-black seeds, looking like a spadix with rudimentary flowers; and finally we got plants with flowers in all stages from anthesis (FIG. 2) to maturity of the capsules (FIGS. 1 and 4). The flowers (FIG. 1), hidden in the sheaths, did not expand, but the scape promptly elongated, the capsule enlarged and we could only conclude that we were dealing with a cleistogamous species. Digging specimens from the peat we were amazed to see the perianth-segments promptly drop off and the three white valves of the capsule as promptly separate and roll back, exposing the seed-covered placenta. The disturbance caused by removing the plants from the soil so promptly induced this startling reaction, completed in a few seconds, in all full-grown capsules that we found it difficult to secure material young enough to retain the flowers and capsules intact. That was early in August, 1934, when flowers and fruits in all stages were present. In May, 1935, Mr. Griscom and I could find no signs of the plant at the original (and only known) station, but in mid-June he, Mr. Long and I secured a good series, with flowers, as always, unexpanding, well-grown fruit and circumscised and dehisced capsules.

Hypoxis Longii, therefore, has capsules of the most extreme type described by Baker, who defines only a few species, all in his subgenus *Ianthe*, suggesting it: "capsula turbinata membranacea infra collum circumscissa" (*H. stellata* from the Cape of Good Hope); "Capsula . . . medio circumscissa, demum irregulariter trivalvis" (*H. pusilla* of New Zealand, Tasmania and Australia); and "Capsula . . . infra collum circumscissa, valvis haud dehiscentibus" (*H. glabella* of Australia and Tasmania). The subgenus *Ianthe*, known to

Baker only from the Australian region and South Africa and containing some species with capsules dehiscent into 3 valves, has basifixed anthers; Baker's subgenus *Euhypoxis,* containing the bulk of the genus, has them versatile. It is, therefore, of the highest significance that mechanical opening out of a flower (FIG. 3) of *H. Longii* exposes the basifixed anthers of *Ianthe.*

In Miss Brackett's detailed *Revision of the American Species of Hypoxis,*[1] she recognized only one species in America with the basifixed anthers of subgenus *Ianthe.* This was the very rare *H. sessilis* L., which has a large open yellow perianth. In her account Miss Brackett quoted from a letter from M. A. Curtis to Asa Gray, written in September, 1853, accompanying over-mature autumnal material of *H. sessilis* from Society Hill, South Carolina: "I send also an abortive Hypoxis now not uncommon here as a second growth of the season. Flowers 3-cleft, white." Miss Brackett also referred to material of *H. sessilis* sent by Miss Bragg from Dackon, Berkeley Co., South Carolina, June 21, 1920, as having "flowers . . . only three-cleft." Examination of the Curtis and the Bragg material clearly shows that what Curtis took for "abortive" 3-cleft white flowers and what Miss Brackett evidently so interpreted are the dehisced and empty capsules. *H. sessilis,* therefore, like *H. Longii,* belongs to subgenus *Ianthe,* not only in its basifixed anthers, but in its circumscissile capsules which soon split into 3 membranous valves. The seeds are very similar in both, olivaceous and covered with a closely reticulate iridescent testa and with the rostrate hilum lateral, instead of subterminal. The distinctions between the two follow:

H. SESSILIS. Perianth expanding, with rotate limb 1.5–2 cm. broad, bright yellow above; sepals and petals 6–9 mm. long, 2–4 mm. broad, the sepals only sparingly pilose on the back; capsule pyriform, 3–4 mm. long, the tardily deciduous beak fully twice its length, 6–10 mm. long; seeds coarsely reticulate, golden-brown to pale olive.

H. LONGII. Perianth remaining closed, when dissected open 5 mm. broad; sepals and petals 2–3 mm. long, 0.5–1 mm. broad, whitish above, the sepals with very long white appressed beard extending far beyond the tips; capsule thick-clavate, 8–10 mm. long, promptly circumscissile at summit, throwing off the beak, then promptly splitting from the apex into 3 membranous whitish valves; beak (before circumscission) about half as long as capsule, 4–5.5 mm. long; seeds olive-black, more finely reticulate.

Hypoxis Longii is known from only a single small area, where it is associated with a series of austral species of peats and damp sands: *Panicum ensifolium* Baldw., *Rynchospora rariflora* (Michx.) Ell., *R.*

[1] RHODORA, XXV. 120–147, 151–155 (1923).

Wrightiana Boeckl. and *R. cymosa,* var. *globularis* Chapm., *Lobelia Nuttallii* R. & S., etc. Search southward to the North Carolina line has thus far failed to show another colony of it. Very similarly, *H. sessilis* is an extremely scarce plant; only a few stations for it are known and in writing of the colony in Berkeley Co., South Carolina, Miss Bragg said: "I spent over an hour searching for specimens in the one locality where these were gathered but, though I am sure there were many more, I could find only two specimens with seeds. The plants are indistinguishable from single tufts of broom grass until you get down to them in back-breaking fashion." Similarly, at the one spot in Virginia where *H. sessilis* has been found (Dam Neck, Princess Anne Co., *Fernald & Griscom,* no. 4368), a few miles south of the colony of *H. Longii,* Mr. Griscom and I found a single individual in May, 1935. Search then and again in June has failed to bring to light a second plant. We took the flowering top and left the corm! As last remnants on the Coastal Plain of North America of the ancient flora now concentrated in Australia no better illustrations could be found than these members of *Hypoxis,* subg. *Ianthe.*

Habenaria cristata (Michx.) R. Br. Occasional in sandy woodlands: Cape Henry, no. 3878; Dam Neck, no. 3879; Munden, no. 3880; abundant in wet, peaty clearings in woods of *Pinus serotina,* south of Grassfield, no. 3881.

Pogonia ophioglossoides (L.) Ker. Occasional in boggy swales and peaty depressions: Rifle Range, no. 3876; False Cape, no. 3877.

Goodyera pubescens (Willd.) R. Br. Occasional in rich woods: Little Neck, no. 3871.

Liparis liliifolia (L.) Richard. Occasional in rich woods: Little Neck, no. 3869, also *F. G. & L.,* no. 4623; Great Neck, *F. & G.,* no. 4375.

Malaxis unifolia Michx. Scattered, usually as 1 or few individuals, in rich woods: Little Neck, no. 3870; Back Bay, *F. G. & L.,* no. 4622.

(*To be continued*)

MIDSUMMER VASCULAR PLANTS OF SOUTHEASTERN VIRGINIA

M. L. Fernald

(*Continued from page 413*)

Salix sericea Marsh. Wet peaty clearings in woods of *Pinus serotina*, south of Grassfield, no. 3887.

It is most surprising to find this essentially northern and continental species growing in typical wet pine barren, with characteristic austral plants such as the *Myrica* next noted. *S. sericea,* as previously represented in the Gray Herbarium from Virginia, has come from the piedmont and mountains only.

Myrica Curtissi Chevalier, var. media (Michx.) Cheval. Mon. Myric. 186 [270] (1901). Wet peaty clearings in woods of *Pinus serotina*, south of Grassfield, no. 3890 (small-leaved form).

This is the first record of any form of *Myrica Curtissi* from north of South Carolina; but several specimens from southern New Jersey belong to var. *media*. We have three species of Wax Myrtle or Candle Berry north of Florida. *M. cerifera* L. (including true *M. caroliniensis* Mill., not recent authors) is either a shrub or tree with the coriaceous and evergreen narrowly oblanceolate leaves varying from entire to sharply serrate, and with the smallest fruit of our three species. *M. Curtissi* Cheval. is also evergreen, with coriaceous lustrous foliage oblong to narrowly obovate. The typical form of the species has glabrous foliage and branches, but var. *media* has the expanding leaves strongly pubescent, the mature leaves more or less velutinous and the dark (blackish) bark of the branches permanently somewhat pubescent. Its fruits are described as slightly larger than in *M. cerifera*. The third species is the deciduous-leaved shrub or small tree of the Atlantic slope: leaves oblong to narrowly obovate, submembranaceous, opaque; bark of mature branches whitish-gray and glabrous; fruits 3.5–4.5 mm. in diameter. This shrub, extending north to southern Newfoundland and the Magdalen Islands, is erroneously passing as *M. caroliniensis* Mill. Miller clearly described the variation of *M. cerifera* with most serrate leaves and cited for it a characteristic plate of Catesby. The wrong interpretation of *M. caroliniensis* is clearly discussed by Chevalier, who correctly takes up for the deciduous-leaved and northern species the name *M. pensilvanica* Loiseleur. Loiseleur gave a beautiful characterization of the northern Bayberry and an excellent plate. The name *M. pensilvanica* had formerly crept into horticultural lists but its first clear definition seems to have been that of Loiseleur.

Typical glabrous Myrica Curtissi was extended northward into Virginia in May, 1935: pine woods near Benefit, *Fernald & Griscom*, no. 4380.

Carpinus caroliniana Walt. Common in swampy woods or occasionally in dry woods: Blackwater River, no. 3894; west of Pungo, *F. & G.*, no. 4382.

Carpinus caroliniana (plate 394) in the swamps and wet woods of southeastern Virginia looked strange to our northern eyes. Its slender trunks were covered with ashy-gray bark, instead of the steel-blue or blue-gray cortex which in the North gives the tree the name "Blue Beech." The leaves, too, looked unfamiliar, small and oblong, with very short teeth, suggesting, very superficially, those of *Amelanchier oblongifolia*. Study in the herbarium shows, indeed, that all the material from the southern coastal plain, from Florida to eastern Texas, thence north into southernmost Illinois and to eastern Virginia, the leaves of the fruiting branches are oblong to narrowly oblong-ovate, 1–3.5 (very rarely –4) cm. broad, 2.5–8 cm. long, acute (but not subcaudate) at tip, with comparatively low serration (figs. 6–10), the small teeth rarely 1 mm. long. The bracts (figs. 2–5) of the fruiting ament are obtuse or subacute, the few teeth blunt or at least not sharp-pointed. The calyx-lobes (figs. 2–5) at summit of the fruit are usually well developed, sometimes quite conspicuous (especially fig. 2).

The tree of the North (plate 395), from Nova Scotia to Ontario and Minnesota, south through the northern states and in the uplands to North Carolina and Arkansas, has bluer bark; it also has larger and more oval leaves with a caudate-acuminate tip, with sharper and longer teeth (figs. 5–7), mostly sharper-toothed bracts (figs. 2–4) and usually very reduced calyx-lobes. That the small-leaved extreme of the southern Coastal Plain is what Walter must have had when he gave his brief diagnosis of *Carpinus caroliniana* in his Flora Caroliniana, written at Santee, South Carolina, there is scarcely a doubt. It, therefore, becomes necessary to find the proper name for the wider-ranging northern and inland tree. It is reasonably certain that it must be *Carpinus Betulus virginiana* Marshall, Arb. Amer. 25 (1785), for Marshall must have had the northern variety; and his characterization of the "oval, pointed leaves, sawed on the edges" is sufficiently definite. Since there is variation in all the characters I feel that the two trees are geographic varieties rather than distinct species. I, therefore, propose to call the larger-leaved variety

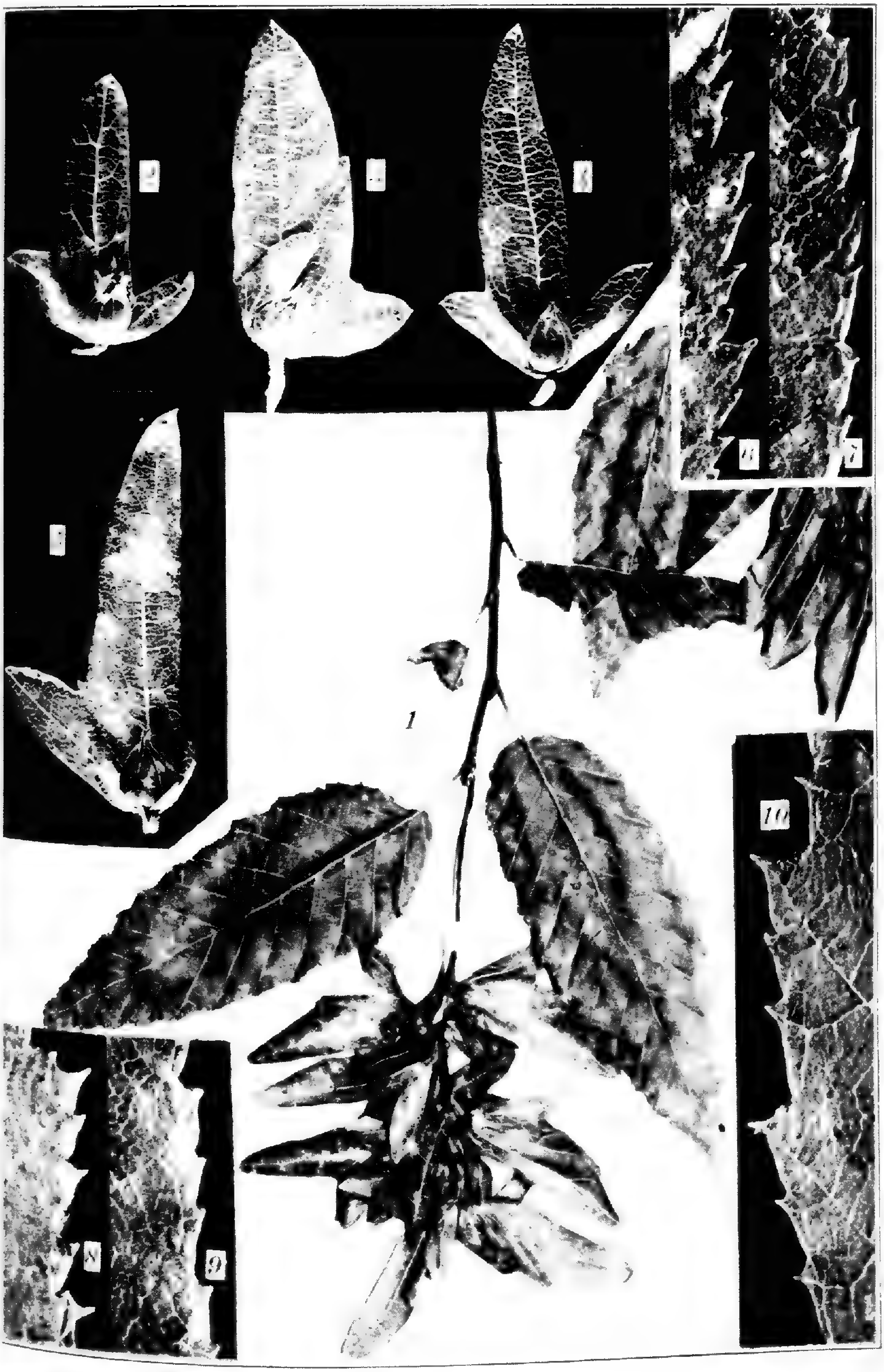


Photo. E. C. Ogden

CARPINUS CAROLINIANA: FIG. 1, fruiting branch, × 1; FIGS. 2–5, bracts and fruits, × 2; FIGS. 6–10, margins of leaves, × 5.

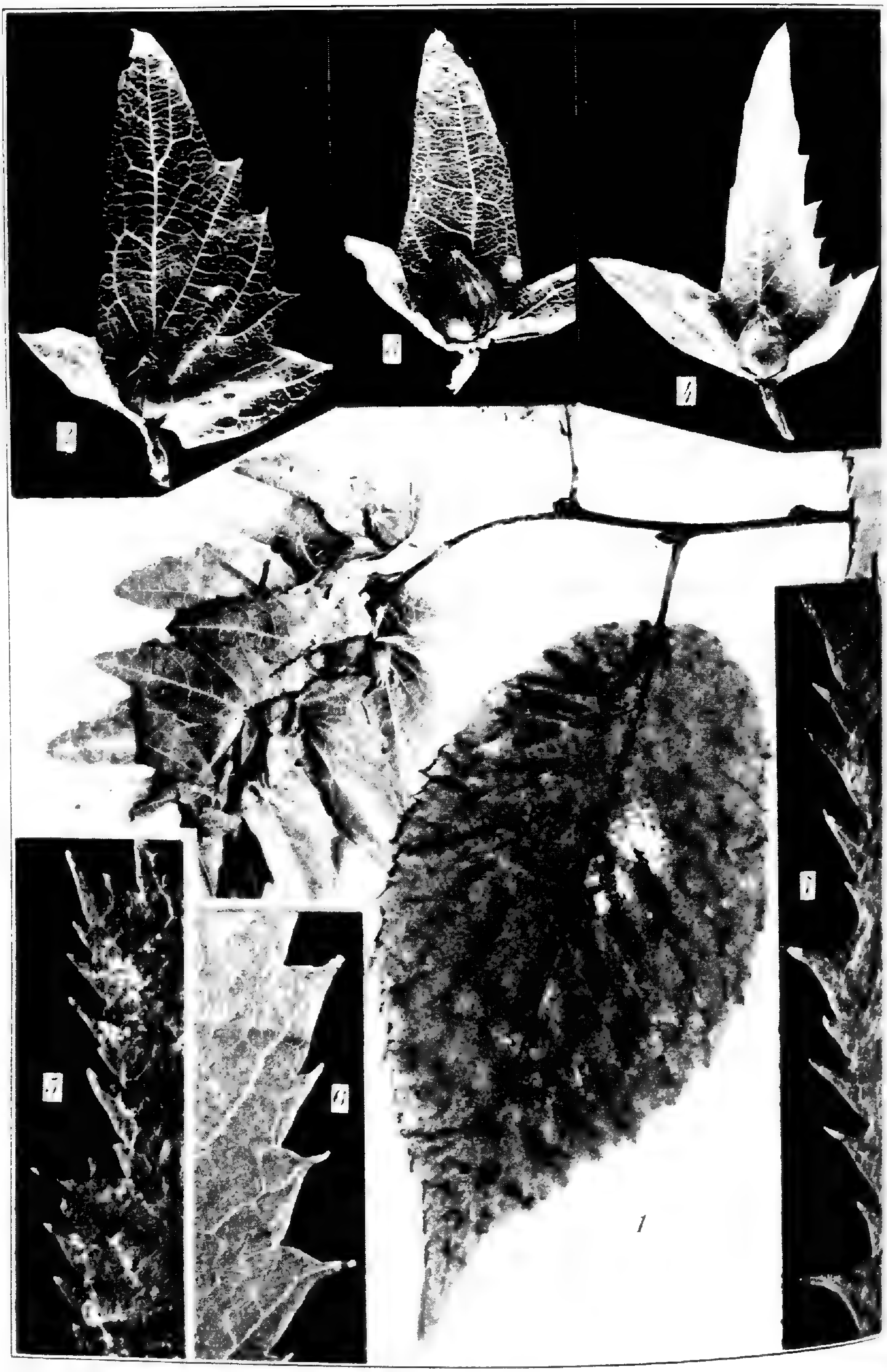


Photo. E. C. Ogden

CARPINUS CAROLINIANA, var. VIRGINIANA: FIG. 1, fruiting branch, × 1; FIGS. 2–4, bracts and fruits, × 2; FIGS. 5–7, margins of leaves, × 5.

Carpinus caroliniana Walt., var. **virginiana** (Marsh.), comb. nov. *C. Betulus virginiana* Marsh. Arb. Amer. 25 (1785). Bark blue-gray; leaves of fruiting branches oval or narrowly ovate, rounded or cordate at base, abruptly subcaudate at tip, 5–12 cm. long, 2.5–6 cm. broad, with sharp and slender teeth, the larger teeth 1–3 mm. long; bracts usually with 1–5 sharp teeth; calyx-lobes at summit of fruit short.—Nova Scotia to Ontario and Minnesota, south to uplands of North Carolina and Arkansas. Plate 395.

Betula nigra L. Local, mostly sprout-growth, perhaps of more general occurrence than appears: wet peaty clearings in woods of *Pinus serotina*, south of Grassfield, no. 3895; sandy pine woods, Sand Bridge, *F. G. & L.*, no. 4629.

Celtis occidentalis L., var. **submembranacea**, var. nov., foliis anguste ovatis apice longe attenuatis maturis submembranaceis utrinque viridibus.—Southeastern Virginia to eastern Georgia. The following are referred here. Virginia: sandy woods, northern end of Knott's Island, Princess Anne Co., August 1, 1934, *Fernald & Long*, no. 3910 (type in Gray Herb.); rich woods, Cedar Island in Back Bay, June 20, 1935, *Fernald, Griscom & Long*, nos. 4630, 4631 (trunks up to 6 dm. or 2 feet in diameter). North Carolina: large trees seen, but no specimens taken, Knott's Island. South Carolina: locality not stated, *M. A. Curtis*. Georgia: bank of Chattahoochee River, Cobb Co., July 9, 1900, *R. M. Harper*, no. 166.

Var. *submembranacea* is at once characterized by having the mature leaves submembranaceous and deep-green on both sides, the other varieties of *Celtis occidentalis* having them firmer and thicker and paler beneath or on both sides. Although Sargent, Bot. Gaz. lxvii. 218 (1919) placed Harper's no. 166 with var. *canina* (Raf.) Sargent, l. c. 217, it has the thin and deep-green foliage of var. *submembranacea*, the mature leaves shriveling or wrinkling in drying.

Aristolochia Serpentaria L. Dry, mixed woods, Little Neck, no. 3913.

Polygonum glaucum Nutt. Sand at upper border of salt marsh, Wachapreague, no. 3919.

P. prolificum (Small) Robinson. Upper border of salt marsh, Wachapreague, no. 3918.

P. opelousanum Riddell. Frequent in sloughs and pond-margins: Pungo, *F. & G.*, no. 2816.

P. setaceum Baldw. Frequent in swampy woods: Blackwater River, no. 3916; Little Neck, no. 3917.

Chenopodium leptophyllum Nutt. Back of the sand dunes, Cape Henry, no. 3924.

Apparently the first coastal record from south of New Jersey.

Acnida cannabina L. Brackish or saline marshes, frequent: North Landing River, *F. & G.*, no. 2820.

Sesuvium maritimum (Walt.) BSP. Very scarce, damp sand and clay back of the ponds, Dam Neck, no. 3925, only one plant seen.

The first material in the Gray Herbarium from between Delaware and North Carolina.

Arenaria lanuginosa (Michx.) Rohrb. Sprawling and leaning on other vegetation, in dry, mixed woods, and supported on *Smilax* tangle to a height of 1.3 m., Little Neck, nos. 3927, 3928; similar habitat, Great Neck, *F. G. & L.*, no. 4637.

The first records from north of North Carolina.

Aquilegia canadensis L. Rich woods and banks, local, the plants very tall: Little Neck, no. 3930; Great Neck, *F. & G.*, no. 4404.

Caltha palustris L. Very local: along brook in swampy woods, Little Neck, no. 3931.

Anemone virginiana L. Dry mixed woods, Little Neck, no. 3934.

Ranunculus hederaceus L. Wet sand bordering swampy woods and thickets along Back Bay, False Cape, no. 3937; also *F. G. & L.*, no. 4642, growing with strictly indigenous species and seemingly native itself.

Asimina triloba (L.) Dunal. Scattered in rich or swampy woods, the leaves rather smaller than in most inland material, tending to be narrower and more cuneate, thus approaching the foliage of the more southern *A. parviflora* (Michx.) Dunal: Oceana, no. 3940; Great Neck, *F. & G.*, no. 4406.

Decumaria barbata L. Scattered generally through the region, climbing high on trees in rich woods and swamps: London Bridge, no. 3951; Munden, no. 3950; Great Neck, *F. G. & L.*, no. 4648.

Spiraea tomentosa L., var. rosea (Raf.) Fern. Rhodora, xiv. 190 (1912). Local: wet, peaty clearing in woods of *Pinus serotina*, south of Grassland, no. 3955.

Already known from southeastern Virginia, but perhaps isolated there. The material in the Gray Herbarium is otherwise from well inland, from Ontario and Manitoba southward to interior northern Georgia, Tennessee, Arkansas and Kansas. Typical *S. tomentosa*, of acid soils, is not represented in the Gray Herbarium from the coastal plain south of New Jersey. The plant of Grassland is quite like the inland extreme.

Amelanchier oblongifolia (T. & G.) Roem. Common in wet woods, thickets and clearings: Grassfield, no. 3958; North Landing, no. 4426.

A. canadensis (L.) Medic. Rich woods, frequent: Little Neck, no. 3956.

Crataegus Youngii Sarg. The most frequent species seen: scattered in wet woods, swamps and clearings: Grassfield, no. 3960; North Landing, *F. & G.*, no. 4427; Cedar Hill, no. 4428; Virginia Beach, *F. G. & L.*, no. 4651; Cedar Island, no. 4652.

Slight extension north, from North Carolina.

C. CRUS-GALLI L. Occasional near the coast of Princess Anne Co.: Knott's Island, no. 3961.

GEUM VIRGINIANUM L. (*G. flavum* Bickn.) Frequent in rich woods: Little Neck, no. 3963.

G. CANADENSE Jacq., var. GRIMESII Fern. & Weath. Occasional in thickets and borders of woods: Blackwater River, no. 3964; Cedar Island, *F. G. & L.*, no. 4653.

AGRIMONIA ROSTELLATA Wallr. Occasional in rich woods: Little Neck, no. 3966; Little Creek, no. 3969; Virginia Beach, *F. & G.*, no. 2822.

A. MOLLIS (T. & G.) Britton. Rich woods, Little Neck, no. 3967.

A. PARVIFLORA Ait. Border of thicket, south of Grassfield, no. 3968.

ALBIZZIA JULIBRISSIN Durazzini. Abundantly naturalized in thickets and at borders of woods: Munden, no. 2971.

TEPHROSIA SPICATA (Walt.) T. & G. Apparently local: thickets on roadside bank, Creed's, no. 3973.

LESPEDEZA STUEVEI Nutt. Dry woods: Cape Henry, *F. & G.*, no. 2837.

L. INTERMEDIA (Wats.) Britt. Dry border of woods, Pungo Causeway, *F. & G.*, no. 3839.

L. REPENS (L.) Bart. Dry woods, frequent: Virginia Beach, no. 2840.

DESMODIUM NUDIFLORUM (L.) DC. Rich woods, locally abundant: Little Neck, no. 3988; Virginia Beach, *F. & G.*, no. 2828.

D. DILLENII Darl. Dry pine woods, Cape Henry, *F. & G.*, no. 2826.

D. PANICULATUM (L.) DC. Rich woods back of Virginia Beach, *F. & G.*, no. 2832.

D. LAEVIGATUM (Nutt.) DC. Dry pine woods, Macon's Corner, Princess Anne Co., *F. & G.*, no. 2829.

D. OBTUSUM (Muhl.) DC. Mixed woods, Virginia Beach, *F. & G.*, no. 2833.

D. STRICTUM DC. Dry pine woods, Cape Henry, *F. & G.*, no. 2825.

D. MARILANDICUM (L.) DC. Mixed woods, Virginia Beach, *F. & G.*, no. 2827.

STYLOSANTHES BIFLORA (L.) BSP. Dry open woods and thickets: Lynnhaven, no. 3975; Macon's Corner, *F. & G.*, no. 2835.

S. RIPARIA Kearney. Apparently local: border of dry woods, Little Neck, no. 3976.

CLITORIA MARIANA L. Dry open clay land, Virginia Beach, nos. 3982, 3984.

SOME GEOGRAPHIC VARIETIES OF LINUM (PLATE 396).—*Linum medium*, as currently treated, consists of two strongly defined geographic varieties, differing in several fairly constant, though somewhat confluent characters, as follows.

Leaves elliptic, oval or elliptic-obovate, obtuse or subacute, opaque, without obvious veins shown by transmitted light, only the uppermost subulate-tipped, 25–40 below the inflorescence: sepals about equaling to shorter than the capsule; the longer 2–3 mm. long; the inner ovate, entire or but sparingly glandular-ciliate: false septa strongly developed, the capsules promptly splitting into 10 valves. . . . *L. medium*, var. *typicum.*

Leaves linear or linear-lanceolate to lance-elliptic, subtranslucent, with evident veins shown by transmitted light, all but the lowermost with prolonged subulate tips, 30–150 below the inflorescence: sepals mostly exceeding the capsule; the longer 2.5–5 mm. long; the inner ovate to lanceolate, usually copiously glandular-ciliolate: false septa less regularly developed, the capsules often splitting into only 5 carpels or tardily or incompletely into 10 valves. . . . . Var. *texanum.*

L. MEDIUM (Planchon) Britton, var. **typicum.** *L. virginianum*, var. β. *medium* Planchon, Lond. Journ. Bot. vii. 480 (1848). *L. medium* (Planch.) Britton in Britt. & Brown, Ill. Fl. ii. 349 (1897), as to name-bringing synonym, not as to description and figure. *Cathartolinum medium* (Planch.) Small. N. Am. Fl. xxv[1]. 72 (1907), as to name-bringing synonym, not as to description.—Southern Ontario (York Co. to Bruce Co.), northwestern Pennsylvania and northern Ohio. FIGS. 1–5.

Var. **texanum** (Planch.), comb. nov. *L. virginianum*, var. δ ? *texanum* Planch. l. c. 481 (1848). *L. virginianum*, γ. *angustifolium* Engelm. in Gray, Pl. Wright. 26 (1852). *L. medium* Britt., l. c. in part (description and fig. 2261). *Cathartolinum medium* Small, l. c. in part (description).—Florida to Texas, north to southwestern Maine, northeastern Massachusetts, southern Vermont, eastern Pennsylvania, West Virginia, southern Michigan, northern Indiana, Illinois, Missouri and Oklahoma. FIGS. 6–10.

Linum medium was first recognized by Planchon who treated it, var. *texanum* and *L. floridanum* as varieties of *L. virginianum* L. He correctly understood the latter species, his *L. virginianum*, var. α *microcarpum* being based on the type of *L. virginianum* in the Linnean herbarium. The fruit of the inclusive *L. virginianum* was defined by Planchon with almost complete false septa such as occur in typical *L. virginianum* and in typical *L. medium* ("capsulae parvae depresso-globosae semiseptis fere completis"), while his material of var. *texanum* was immature and Planchon thought that it, as well as *L. floridanum*, might prove to be a distinct species. Planchon's account of the two varieties of *L. virginianum*, here specially significant, was as follows:

Var. *β. medium*,—humilius, ramulis fructiferis strictis erecto-patentibus, calyce capsulam (praecedenti [var. *microcarpum* or typical *L. virginianum*] paulo majorem) paulo superante; fenestra loculorum lineari-angustissima. . . .

Var. δ (?) *Texanum*,—habitu var. α. [*i. e.* elatius, ramulis fructiferis divaricato-patentibus], sed floribus majoribus, laciniis calycinis valde inaequalibus, majore pedicellum brevem et capsulam (non plene maturam) obtusam fere duplo superante. An sp. distincta?

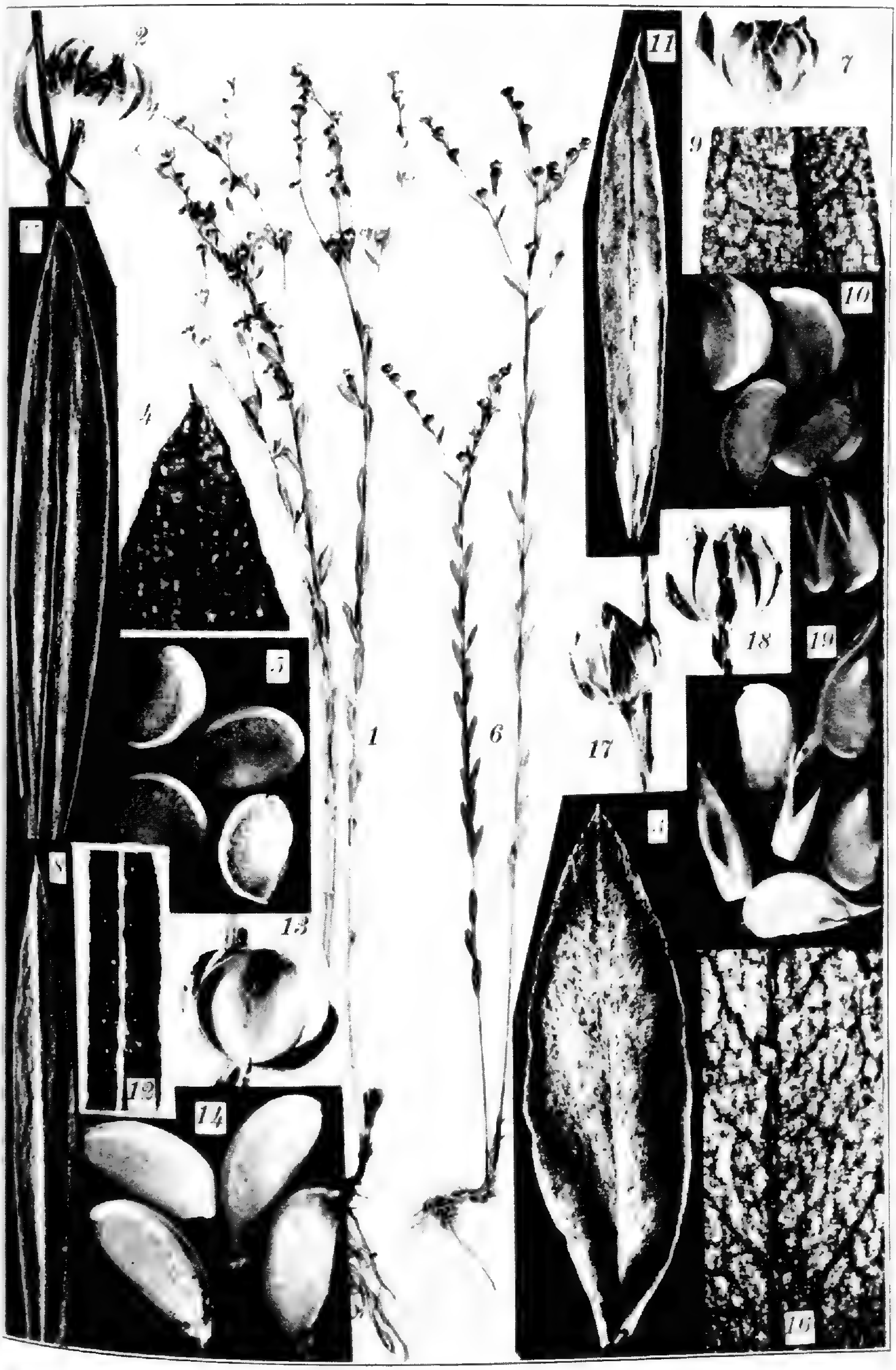


Photo. E. C. Ogden

LINUM: plants, × ¾; leaves, × 5; details of leaf-venation, × 10; capsules, × 5; ripe carpels, × 8.

L. MEDIUM: FIG. 1, small plant; FIG. 2, capsule; FIG. 3, leaf; FIG. 4, portion of leaf (opaque), by transmitted light; FIG. 5, ripe carpels.

L. MEDIUM, var. TEXANUM: FIG. 6, small plant; FIG. 7, capsule; FIG. 8, leaf; FIG. 9, portion of leaf, by transmitted light; FIG. 10, ripe carpels.

L. FLORIDANUM: FIG. 11, leaf; FIG. 12, portion of leaf (opaque), by transmitted light; FIG. 13, capsule; FIG. 14, ripe carpels.

L. INTERCURSUM: FIG. 15, leaf; FIG. 16, portion of leaf, by transmitteed light; FIGS. 17 and 18, capsules; FIG. 19, ripe carpels.

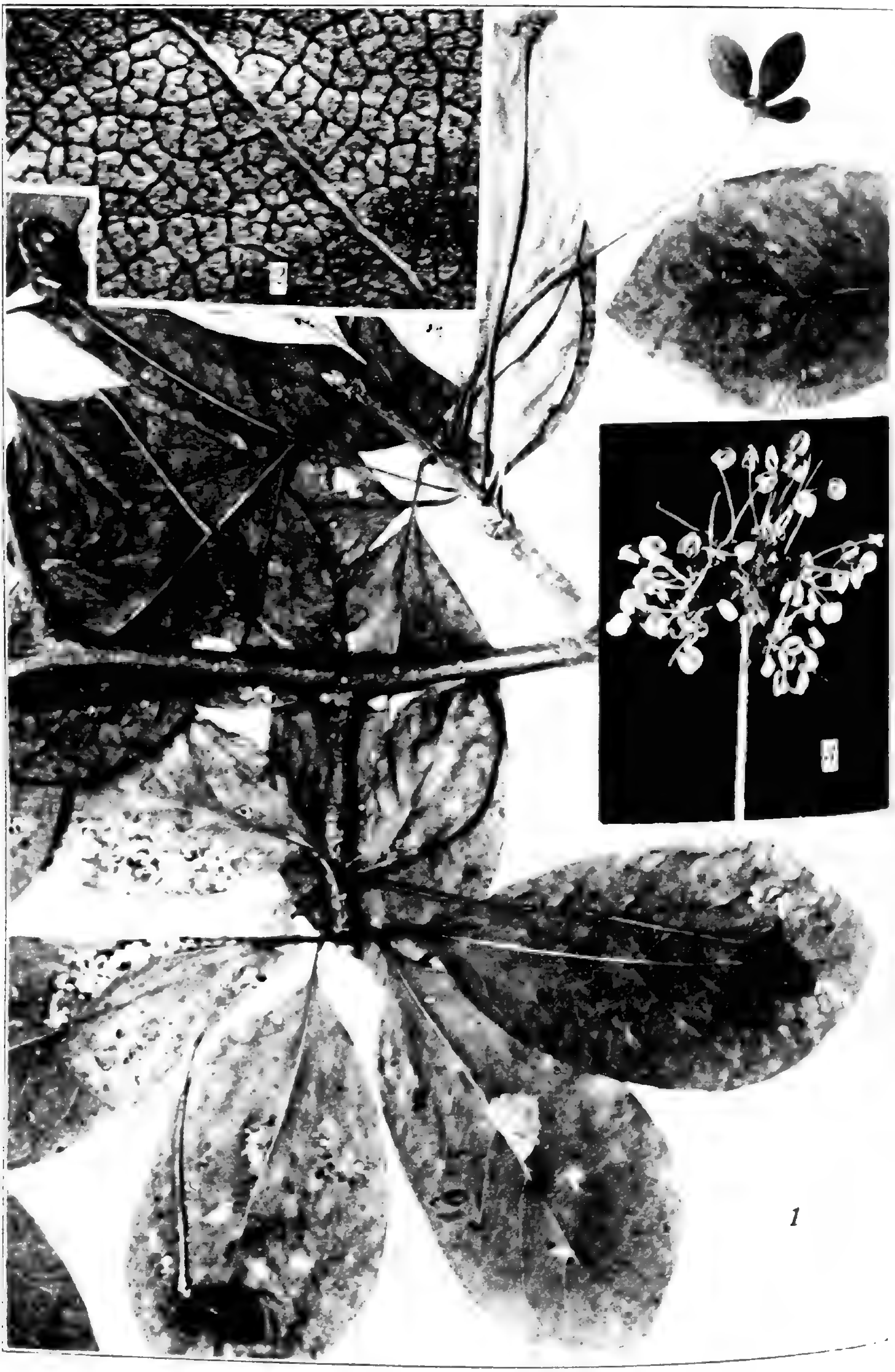


Photo. E. C. Ogden

NYSSA SYLVATICA, var. TYPICA: FIG. 1, fruiting branch, × 1; FIG. 2, smooth lower surface of leaf, × 10; FIG. 3, staminate inflorescence, × 3.

Hab. . . . Var. β, Canada, lacus Huron, *Dr. Todd* in Hb. Hook.; Kentucky, *Dr. Short,* ibid.; alibi verosimiliter in Prov. confederatis.— . . . Var. δ, in ditione Texana, prope S. Felipe, *Drummond,* no. 38. coll. tertiae.

I have not seen the Todd material, which should stand as the type of *Linum medium,* but all other material from southern Ontario, where Todd collected, well matches Planchon's specifications: low, fruiting branches strict, suberect; calyx little exceeding the capsule; and very narrow fenestration of the valves of the fruit. The Ontario plant with these characters comes from shores of Lakes Huron, Ontario and Erie. It ranges from 1.3–4.5 dm. high and has the characters enumerated in the key above.

Fig. 1 shows a characteristic specimen, × ¾ from the Bruce Peninsula, Lake Huron, with enlarged details of the characteristic leaf, calyx, capsule and valves. It is probable that the Kentucky material seen by Planchon was not strictly identical with it.

Linum medium, var. *texanum,* usually taller, with more divergent fruiting branches and with the calyx twice as long as the (young) capsule, was based (as *L. virginianum,* var. *texanum*) on *Drummond,* no. 38 from Texas. An excellent sheet of no. 38, with capsules evidently more mature than in the material seen by Planchon, is in the Gray Herbarium. A small plant from Virginia, closely matching it, is reproduced, × ¾, as fig. 6; and details of leaf, calyx, fruit and valves from it are added. Var. *texanum* may be as low as the average var. *typicum* and its inflorescence may then have short branches. On the whole, however, it is taller, ranging from 1.5–7.5 dm. high, with very many more and narrower, sharp-pointed leaves and elongate branches. As to the septation of the fruit, the 5 carpels in the northern type promptly separate into 10 valves, as Planchon implied and as they usually do in *L. virginianum;* but in the southern variety the carpels are often undivided, though septation occasionally occurs. In this character they show parallelism with the usually non-septate carpels of the southern *L. floridanum* (Planch.) Trel. and their very prompt septation in the more northern and inland *L. intercursum* Bickn. The artist who drew *Linum* for Britton & Brown's Illustrated Flora caught the point: *L. virginianum* (fig. 2260) and *L. striatum* (fig. 2263) showing, correctly, the carpels promptly septate, resulting in 10 valves; *L. floridanum* (fig. 2262) and *L. medium* (var. *texanum*), fig. 2261 (the latter with "leaves . . . lanceolate to linear-lanceolate, acute" and with sepals shown as exceeding the capsule) both correctly illustrated with non-septate valves. But, whereas var.

texanum has carpels and their separated valves barely different from those of typical *L. medium*, *L. intercursum* and *L. floridanum* have marked differences in leaf, fruit and valves, which indicate that they are distinct species; the former of the northern coastal plain, from Massachusetts to Virginia, thence inland and south to western Georgia and northern Alabama; the latter restricted to the southern coastal plain, north to southern Illinois and eastern North Carolina. Figs. 11–14 show the details of *L. floridanum*, a plant with very numerous (50–150) leaves, the middle and upper (fig. 11) linear, opaque (fig. 12) to transmitted light, and with a slender subulate tip 0.5–1 mm. long; capsule (fig. 13) globose-ovoid and rounded at summit; and individual carpels and valves (fig. 14) blunt or with short incurved tips. *L. intercursum*, on the other hand, has fewer (15–60) leaves, these (fig. 15) blunter, showing evident venation (fig. 16) by transmitted light; the capsules (figs. 17 and 18) ovoid and pointed; the individual carpels (fig. 19) with erect, acuminate beaks.

Linum striatum is separated in our keys by special emphasis on the opposite leaves—"leaves below the branches mostly all opposite" (*Britton & Brown*); "Stem-leaves chiefly opposite" (*Robinson & Fernald*). To the field-botanist who has known the species only on Cape Cod, the islands of southeastern Massachusetts or Block Island, off the coast of Rhode Island, such an emphasis might seem insufficient; he would say: leaves of the stem and of the primary axis of the inflorescence all or nearly all opposite. On the mainland of southern New England, however, more of the leaves are alternate; and southward, through Virginia, the Carolinas and Georgia and westward, many or most of the leaves are alternate. It thus becomes interesting to note Walter's original diagnosis of *L. striatum* of Carolina:

> *striatum* 2. *floribus terminalibus*, foliis subovatis alternis, caule ramosiori *striato* foliorum *nervo marginibusque decurrentibus*.

In general, all the southern material and most of that on the continent northeastward to northeastern Massachusetts and inland to the Great Lakes region has the 5–25 upper leaves of the stem and all or essentially all along the primary axis of the loosely branched inflorescence alternate, only the lower 5–10 (rarely –14) nodes having them opposite, thus sufficiently approximating Walter's diagnosis, "foliis . . . alternis." As already stated, the plant of Cape Cod, Martha's Vineyard, the Elizabeth Islands and Nantucket, Massachusetts and of Block Island, off the coast of Rhode Island, has most of the leaves (all below the inflorescence and several pairs on the main axis) opposite. Consequently, the lower and often essentially all the branches of the inflorescence are opposite, producing an inflorescence strikingly unlike that of the continental and southern plant, in which they are alternate. The northern insular and peninsular extreme may be called

LINUM STRIATUM Walt., var. **multijugum**, var. nov., foliis caulinis oppositis, foliis ramibusque imis panicularum oppositis.—MASSACHUSETTS: peaty margin of Quanset Pond, Orleans, September 10, 1927, *Fernald*, no. 620 (TYPE in Gray Herb.); moist sandy and peaty shore, second small pond east of Lizzie's Pond, Chatham, *Fernald & Long*, no. 18,663; open mossy bog, Harwich, August 5, 1913, *Weatherby* (slightly transitional); borders of peaty quagmires east of Buck Pond, Harwich, *Fernald & Long*, no. 17,018; near Pleasant Lake, Brewster, August 3, 1911, *E. W. Sinnott;* cranberry bogs near Walker Pond, Brewster, *Fernald*, no. 17,017; dry sandy upper beach of second pond [Seth's P.] north of No Bottom Pond, Brewster, *Fernald & Long*, no. 17,019; damp sandy and peaty beach of Blueberry Pond, Brewster, *Fernald*, in Pl. Exsicc. Gray. no. 371; peaty margin of Sheep Pond, Cuttyhunk, *Fogg*, no. 2528; border of Waquatuquait Pond, Nantucket, September 7, 1885, *Deane.* RHODE ISLAND: various stations on Block Island, August 17, 1892, *J. F. Collins; Fernald & Long*, no. 9770, *Fernald, Hunnewell & Long*, no. 9771; *Fernald, Long & Torrey*, no. 9772; September 28, 1916, *Collins, Spalding & Gravatt;* August 10, 1919, *C. B. Graves.*

Linum virginianum, var. β. *oppositifolium* Engelm. in Gray, Pl. Wright. 26 (1852) was based on typical *L. striatum*, a plant with which Engelmann was otherwise unfamiliar. Exceptional individuals of *L. striatum* from the mainland of southern New England and from Long Island and New Jersey approach var. *multijugum.*

OXALIS FILIPES Small. Frequent in woods and thickets: Great Neck, *F. & G.*, no. 4443; Benefit, *F. & G.*, no. 4444; Knotts' Island, no. 3998.

POLYGALA INCARNATA L. Dry open clay lands and thickets, frequent in Princess Anne Co.; Virginia Beach, no. 4006.

P. MARIANA Mill. Common in dry or moist open soil: Virginia Beach, no. 4005; Little Neck, no. 4004; Blackwater River, no. 4003; Pungo Causeway, *F. & G.*, no. 2846.

P. VERTICILLATA L. Local: dry open clay lands and thickets, Virginia Beach, no. 4001.

CNIDOSCOLUS STIMULOSUS (Michx.) Engelm. & Gray. Sandhills, Cape Henry, no. 4007.

CROTON GLANDULOSUS L., var. SEPTENTRIONALIS Muell. Arg. Dry sand barrens, Cape Henry, *F. & G.*, no. 2847.

Acalypha virginica L. Occasional, in open clay of thickets and fields: Blackwater River, no. 4009.

A. digyneia Raf. Local, in open clay at border of woods, east of Little Creek, no. 4008.

Phyllanthus caroliniensis Walt. Ditch in open clay at border of woods, east of Little Creek, no. 4011.

Ilex vomitoria Ait. Frequent in sandy woods and thickets: Knotts' Island, no. 4021; Creed's, *F. & G.*, no. 4450.

Ceanothus americanus L. Infrequent: dry, mixed woods, Little Neck, no. 4025.

Ampelopsis arborea (L.) Koehne. Local: thickets on sand dunes south of False Cape, no. 4026.

Ascyrum stans Michx. Frequent in borders of woods and clearings: Little Neck, no. 4040; Grassfield, no. 4041.

Hypericum punctatum Lam. Occasional: dry, mixed woods, Little Neck, no. 4038.

We did not see the following, which has been collected in Henry Co.

Hypericum punctatum Lam., var. **pseudomaculatum** (Bush), comb. nov. *H. pseudomaculatum* Bush in Britton, Man. 627 (1901); Britton in Britton & Brown, Ill. Fl. ed. 2, ii. 534, fig. 2894 (1913).

When first published by Dr. Britton, Bush's *Hypericum pseudomaculatum* was cited only from Missouri, and distinguished from *H. punctatum* only by slightly longer petals. In his second publication, however, he separated it also on its acute leaves and more attenuate sepals, and extended its range eastward to Florida and South Carolina. As to length of petal, it is perfectly simple to find in the herbarium sheets of specimens with the upper leaves subdeltoid and acute (*H. pseudomaculatum*) but with petals as small as in the smallest-flowered *H. punctatum.* In fact, the smallest-flowered extreme, *H. micranthum* Choisy, may have the uppermost leaves either rounded at summit, as in typical *H. punctatum,* or deltoid-ovate and acute, as in *H. pseudomaculatum.* Var. *pseudomaculatum,* which is a southern extreme distinguished primarily by having the uppermost and bracteal leaves acute, extends from Florida to Texas, northward to southern Virginia (Martinsville, Henry Co., *Heller,* no. 1095), western Tennessee, Illinois, Missouri and Oklahoma.

H. nudiflorum Michx. Local: shrubs 0.5–0.9 m. high, at border of gum swamp, Oceana, no. 4039.

Apparently the first record from north of North Carolina.

H. gymnanthum Engelm. & Gray. Frequent in damp sands or clays, Princess Anne Co.: Cape Henry, no. 4036; Virginia Beach, no. 4035; Rifle Range, no. 4037.

H. petiolatum Walt. Gum swamps: Oceana, no. 4032; North Landing, no. 4031.

LECHEA RACEMULOSA Michx. Occasional: border of woods, east of Little Creek, no. 4049.

VIOLA AFFINIS LeConte. Dry, mixed woods, Little Neck, no. 4056.

V. SORORIA Willd. Dry, mixed woods, Little Neck, no. 4055.

V. BRITTONIANA Pollard. Frequent in swales and damp open soil: Rifle Range, no. 4053, also *F. & G.*, no. 4469; Sand Bridge, *F. G. & L.*, no. 4676; Munden, *F. & G.*, no. 4468; North Landing, *F. & G.*, no. 4467; Blackwater River, no. 4054; Richard Swamp, *F. & G.*, no. 4466.

V. PECTINATA Bickn. Local: wood-road in pine woods, Dam Neck, no. 4051; damp peat, Rifle Range, *F. & G.*, no. 4463.

Apparently the first record from south of Maryland. Our collections are quite like Bicknell's original material.

LUDWIGIA GLANDULOSA Walt. Large bushy-branched plants 1 m. high, in gum swamp south of North Landing, no. 4076.

Apparently the first station known north of South Carolina.

L. PILOSA Walt. Wet, peaty clearings in woods of *Pinus serotina*, south of Grassfield, no. 4074, there growing with L. LINEARIS Walt. (our no. 4075).

The first evidence, apparently, of *Ludwigia pilosa* from north of South Carolina.

L. BREVIPES (Long) E. H. Eames, RHODORA, xxxv. 228 (1933) (*Ludwigiantha brevipes* Long). Western Branch of James River, near Portsmouth, August, 1840, *F. Rugel* in Gray Herb.; shallow water, pond along railroad, 37th Street Station, Cape Henry [Virginia Beach], June 26, 1922, *Randolph & Randolph*, no. 331; shallow pools and wet sand of dune-hollows, south of False Cape, Princess Anne Co., no. 4070.

Our station, south of False Cape, is very extensive, within a short distance of the North Carolina line and on one of the outer sand-bar islands which extend to Cape Hatteras and beyond. The species will doubtless be found in North Carolina. The type station, on the New Jersey coast, is the only one known north of Virginia.

HYDROCOTYLE CANBYI C. & R. Frequent in Princess Anne Co.: silts near outlet of Rainey's Pond, Sand Bridge, no. 4090; damp sand and clay back of the ponds, Dam Neck, no. 4091.

H. RANUNCULOIDES L.f. Local: in and by a brook, inundated swale back of the dunes, False Cape, no. 4086.

CICUTA CURTISII C. & R. Gum swamps: Oceana, no. 4083.

ANGELICA VILLOSA (Walt.) BSP. Border of dry, mixed woods, Little Neck, no. 4082.

CORNUS STRICTA Lam. Swamps and margins of creeks: False Cape, no. 4100; Indian Creek, *F. G. & L.*, no. 4648.

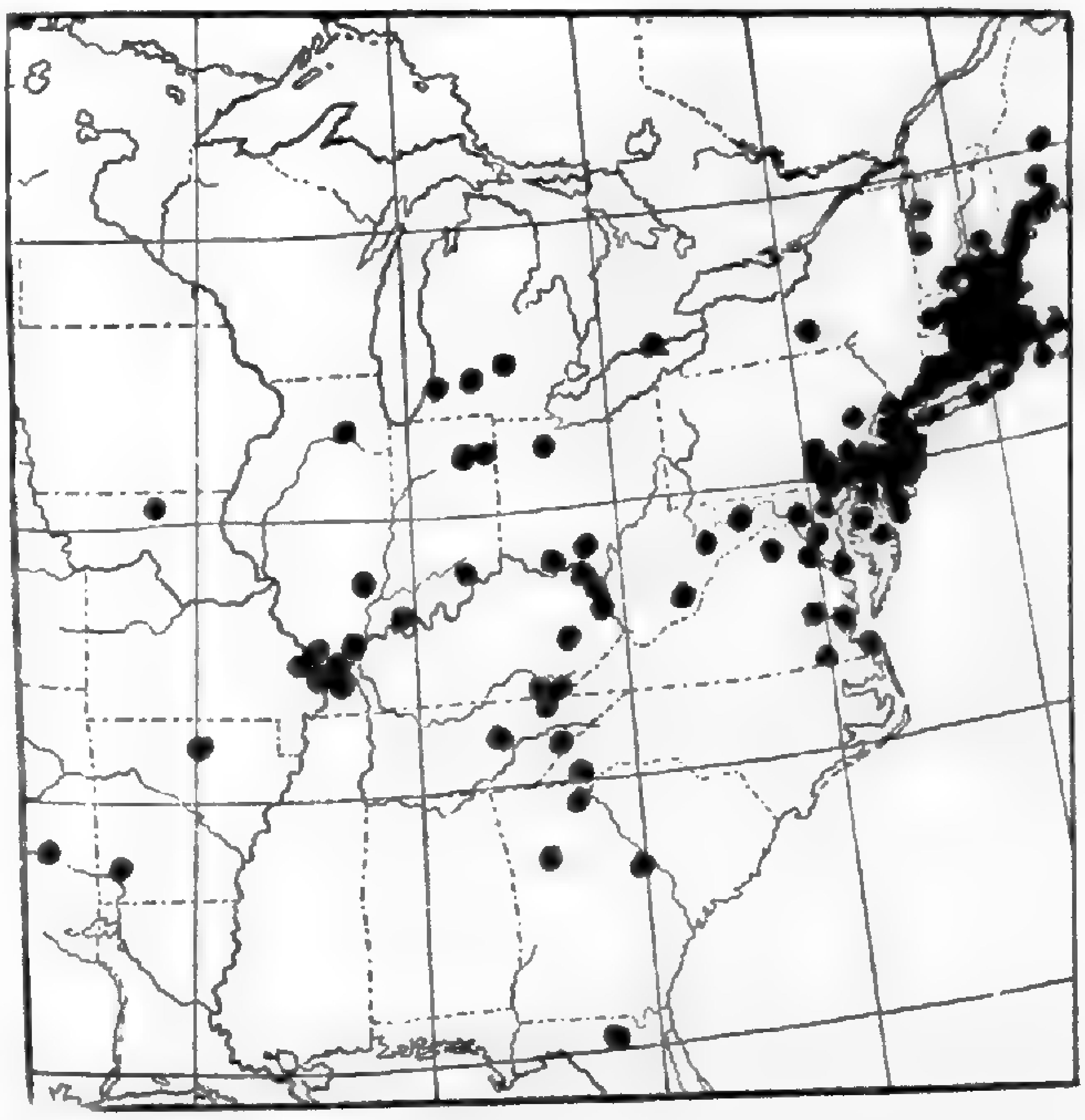
THE VARIETIES OF NYSSA SYLVATICA (PLATES 397–400).—In Princess Anne County we were very much perplexed by the genus

Nyssa. *N. aquatica* L., with its large solitary fruits, was perfectly clear, but the trees with small paired or triple fruits showed such diversity of foliage, two of the extremes often growing within a few miles of each other, that it has seemed important to settle, so far as possible, their identities. Very briefly, I find no very positive differences in flowers and fruits in the series including *N. sylvatica* Marsh. and *N. biflora* Walt. Another of the series, not recently recognized, is *N. caroliniana* Poiret, in which the foliage and fruits are somewhat larger than in the other two, but with so many transitions that I am forced to treat them as well marked varieties. From the description "with oval, or rather inverse egg-shaped leaves" and from the region whence it came (Pennsylvania) *N. sylvatica* Marsh. is clearly the northern extreme, with long fruiting peduncles, short staminate pedicels and elliptic to obovate, abruptly short-pointed and comparatively small leaves smooth beneath. *N. biflora* Walt., from the brief diagnosis "foliis oblongo-lanceolatis integerrimis, laevibus", is safely identified as the narrow-leaved tree with short peduncles already generally understood as *N. biflora*. *N. caroliniana* Poir., with leaves long-tapering to both ends and with long staminate pedicels, I take to be the tree of the series with longest leaves, conforming to the general outline shown in Poiret's illustration. A fourth extreme, somewhat similar to *N. caroliniana*, but with broadly oval to short-oblong leaves, is in some points about as near true *N. sylvatica* but usually with shorter fruiting peduncles and longer staminate pedicels; in other points suggestive of a broad-leaved *N. biflora*. This is distinctly a southern tree and I am unable to identify it with any described form. In order to show the four varieties of *N. sylvatica*, as I view them, it seems desirable that they be illustrated (plates 397–400). The maps of ranges are based on all the material at the Arnold Arboretum and the Gray Herbarium.

The following brief characterizations, with the illustrations, may make my treatment clear.

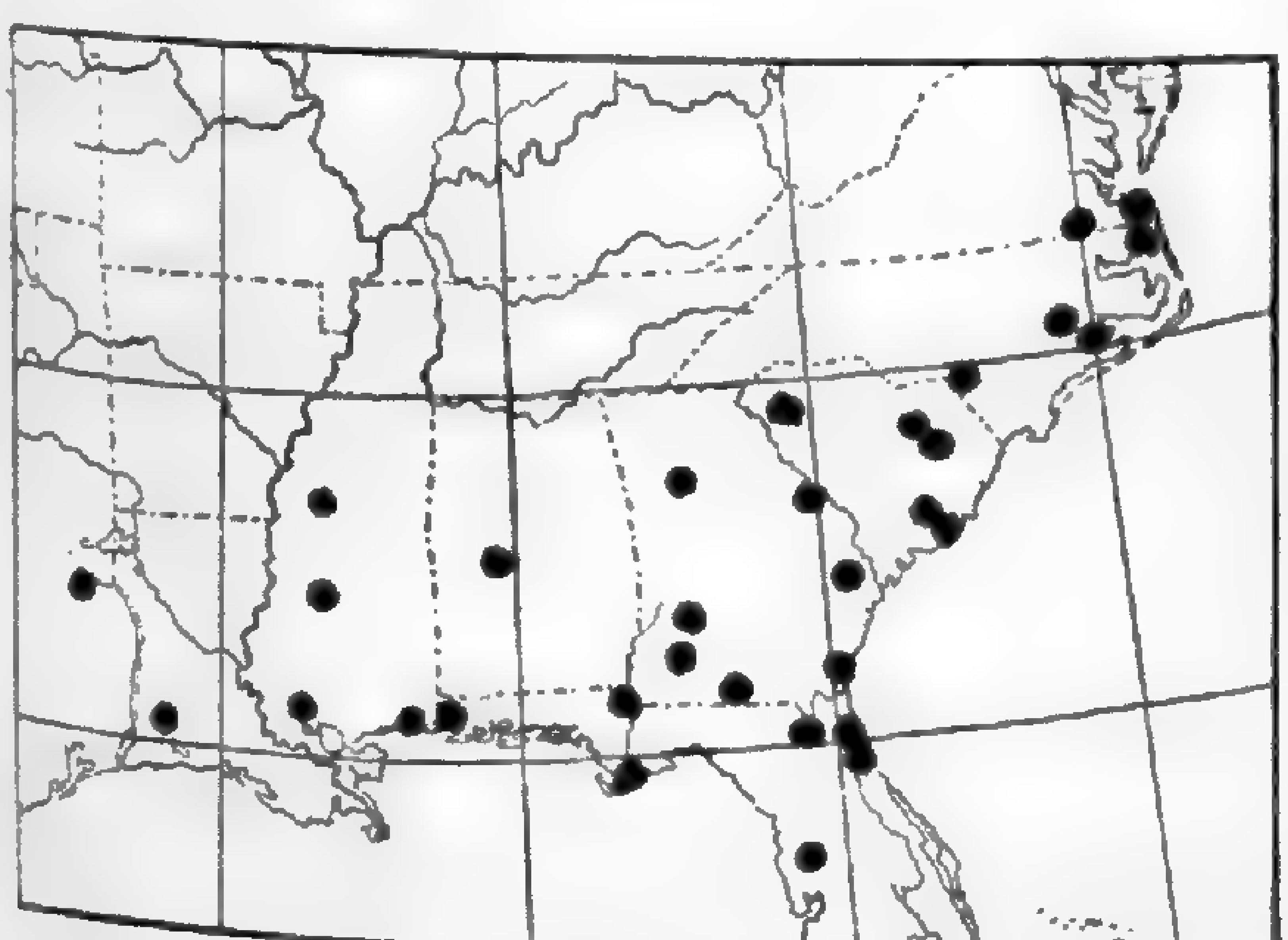
Nyssa sylvatica Marsh., var. **typica**. *N. sylvatica* Marsh. Arb. Amer. 97 (1785). *N. multiflora* Wang. Nordam. Holz. 46, t. 16, fig. 39 (1787). *N. multiflora*, var. *sylvatica* (Marsh.) Wats. Bibl. Index, 442 (1878).—Leaves adjacent to flowers and fruits (excluding those of vegetative sprouts and leading tips) obovate to elliptic, frequently with short abrupt tip, firm or subcoriaceous, lustrous above, smooth (rarely papillate) and glabrous or glabrate (except sometimes on nerves) beneath, 3–8(–10) cm. long, 2–6 cm. broad: fruiting peduncles (1.5–)3–6.5 cm. long: staminate pedicels 0.5–4 mm. long.—West-central Maine to northern Missouri, south to Virginia and Tennessee and more locally to northern Florida and northeastern Texas. PLATE 397; MAP 1.

Var. BIFLORA (Walt.) Sarg. Sylva, v. 76, t. ccxviii. (1893). *N. biflora* Walt. Fl. Car. 253 (1788).—Leaves coriaceous, those adjacent to flowers and fruits oblanceolate, narrowly obovate or narrowly oblong-lanceolate, round-tipped, obtuse or subacute, lustrous above, smooth or papillate beneath, 2.5–6(–9) cm. long, 1.5–3.5 cm. broad: fruiting peduncles 1–3.5 cm. long; staminate pedicels 3–5 mm. long.—Coastal plain, southeastern Maryland to Florida, thence to eastern Texas, inland, locally, into the piedmont. PLATE 398; MAP 2.[1]



MAP 1. Range of NYSSA SYLVATICA, var. TYPICA.

Although Sargent in his later work (Manual) and Small maintain *Nyssa biflora* as a species, said to have "Stone prominently ribbed" (*Sargent*) as opposed to "Stone indistinctly ridged" in *N. sylvatica*, I get little distinction: to me they are both furrowed but without any striking difference. When growing in "gum swamps," with abundant water, the bases of the trunks of var. *biflora* are enlarged or swollen, but when growing in damp sands, away from standing water, they do not show this basal enlargement. I am, therefore, in full accord with Sargent's earlier statement, in the Sylva: "This aquatic tree often appears distinct enough from the northern

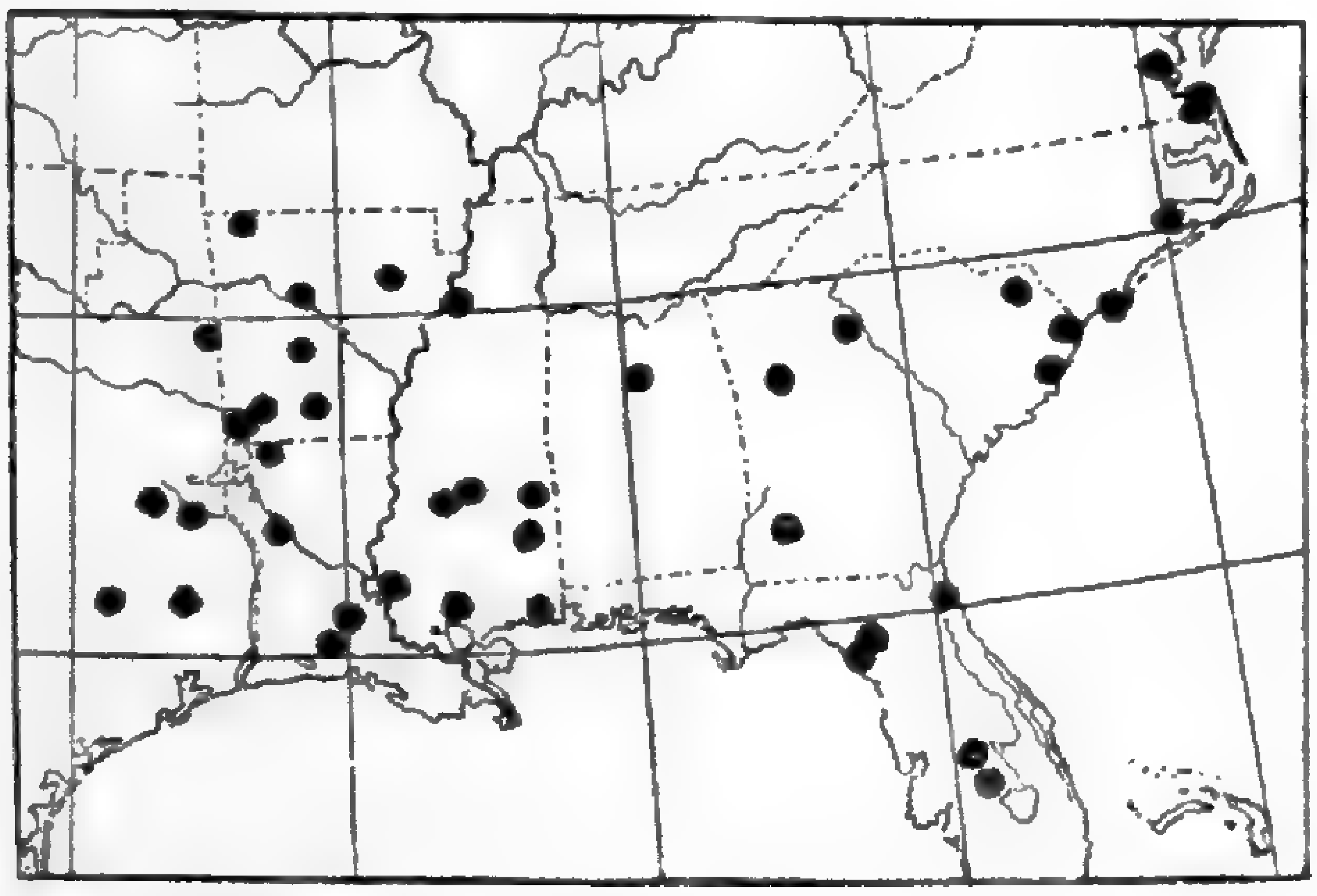


MAP 2. Range of NYSSA SYLVATICA, var. BIFLORA.

[1] The range of var. *biflora* should be indicated as extending northward to southeastern Maryland.

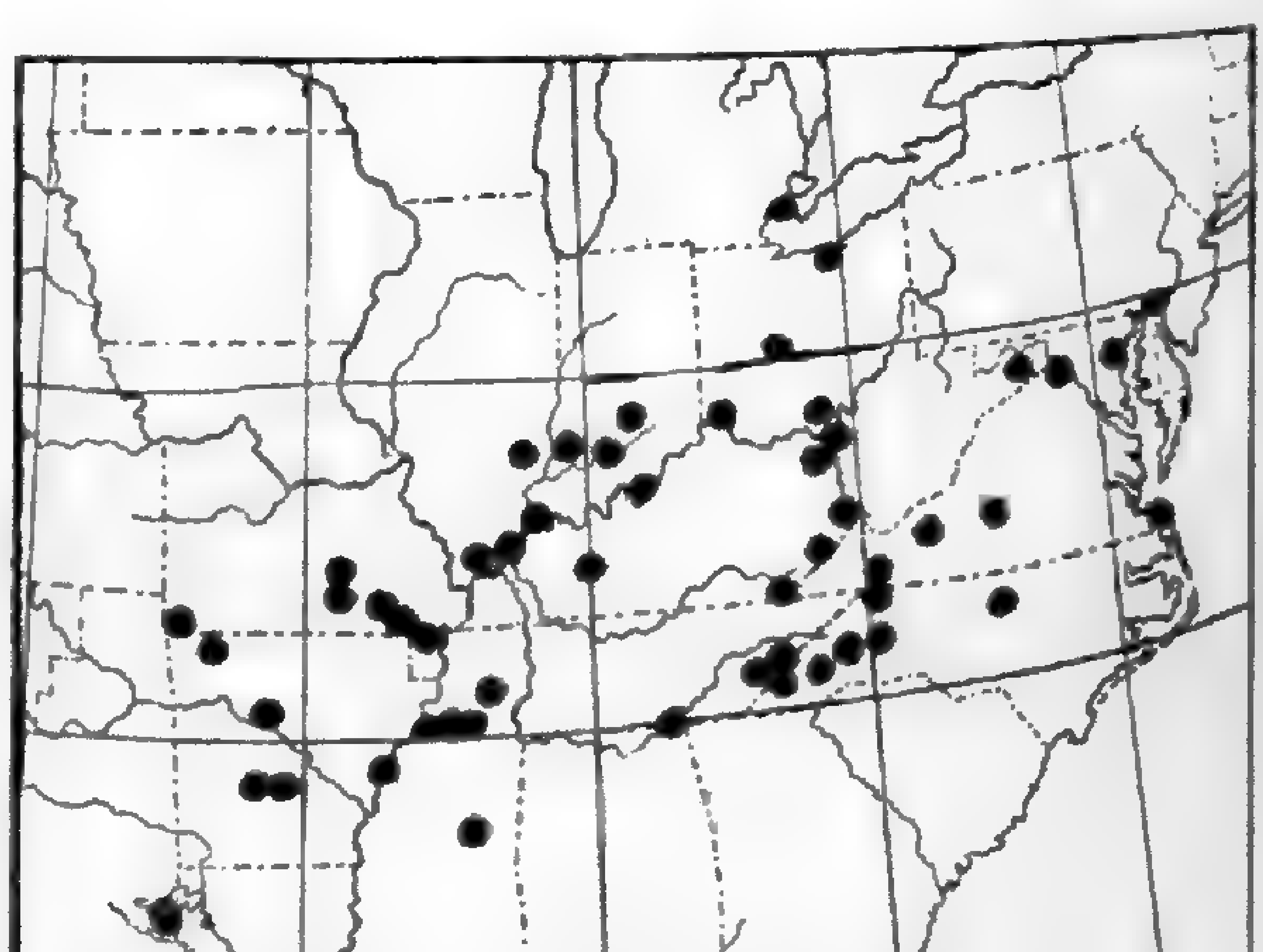
Tupelo, but the extreme forms are connected by others intermediate between the two in the shape and size of their leaves and in the shape and ridges of their stones." Var. *biflora* passes into

Var. **dilatata**, var. nov. (TAB. 399), foliis maturis late ovalibus vel rotundato-oblongis vel late obovatis apice rotundatis subcoriaceis supra lucidis subtus planis vel papillatis pilosis vel glabris; fructi pedunculis 1.5–5 cm. longis; florum staminiorum pedicellis 3–8 mm. longis.—Coastal plain, rarely piedmont, southeastern Virginia to Florida, thence to eastern Texas, eastern Oklahoma and Arkansas. TYPE (PLATE 399): low ground, sandy oak-pine woods, 4 miles southwest of Hartwell, Hart Co., Georgia, August 19, 1927, *Wiegand & Manning*, no. 2339 (Gray Herb.). MAP 3.



MAP 3. Range of NYSSA SYLVATICA, var. DILATATA.

Var. **caroliniana** (Poir.), comb. nov. *N. Caroliniana* Poir. in Lam. Encycl. iv. 507 (1796) and Ill. iii. 442, t. 851, fig. 1 (1823).—Leaves submembranaceous to thin-coriaceous; those adjacent to flowers and fruit rhombic-oval to rhombic-obovate, tapering subequally to the usually acuminate (rarely blunt) base and apex, papillose and frequently pilose beneath, (6–) 8–15 cm. long, 3.5–8 cm. broad: fruiting peduncles 1.5–5 cm. long; pedicels of staminate flowers 2–4.5 mm. long. —Chiefly in the uplands and the interior, Chester County, Pennsylvania to Essex Co., Ontario, thence to southeastern Virginia, interior North Carolina, Tennessee, northern Mississippi and eastern Texas. PLATE 400; MAP 4.



MAP 4. Range of NYSSA SYLVATICA, var. CAROLINIANA.

Photo. E. C. Ogden.

NYSSA SYLVATICA, var. BIFLORA: FIG. 1, fruiting branch, × 1; FIG. 2, staminate inflorescence, × 3.

Photo. E. C. Ogden

NYSSA SYLVATICA, var. DILATATA: FIG. 1, fruiting branch (TYPE), × 1; FIG. 2, staminate inflorescence, × 3.

The dominance of var. *caroliniana* in the Appalachian and Ozark Uplands, whence it spreads locally into the lower levels, is striking. It there reaches higher altitudes than typical *Nyssa sylvatica*, some collections (for example, from Walker Mountain, Smyth Co., Virginia, *Small*) recorded as from 3000 feet, others from "summits" of mountains. Within four miles of the Atlantic, on the outer coastal plain, we found var. *caroliniana* (Oceana, Princess Anne Co., no. 4097) associated with other inland types (*Asimina triloba, Morus rubra, Ulmus americana, Carex virescens*, etc.) and only a short distance from colonies of *Thelypteris hexagonoptera, Liparis liliifolia, Liriodendron Tulipifera, Oxydendrum arboreum* and other Alleghenian types. Within an equally short distance were the coastal plain *N. sylvatica*, var. *biflora* and hundreds of other southern coastal plain types.

I am placing the Alleghenian tree with *Nyssa caroliniana* Poir. on account of Poiret's figure, which seems to represent this variety. His description called for "feuilles . . . ovales, . . . aiguës à leurs deux extremités, . . . glabres des deux côtés . . . Cet arbre crôit naturellement dans la Virginie & la Caroline." At the same time Poiret published *N. canadensis:* "Cette espèce a beaucoup de rapports avec le précédente, peut-être même n'en est-elle qu'une variété, quoique d'un pays différent. C'est le même port, la meme disposition dans les feuilles & les fleurs; cependant les feuilles, au lieu d'etre glabres, sont fortement velues en-dessous sur leurs principales nervures, & ciliées à leur circonference . . . Cette plante a été envoyée du Canada au citoyen Lamarck." Without seeing Poiret's type it is not possible to say whether he had var. *caroliniana* or var. *typica*, both of which extend into southernmost Canada.

Vaccinium macrocarpon Ait. Swampy or inundated woods, north of Blackwater River, Princess Anne Co., no. 4123.

It was certainly surprising to find the cranberry on the coastal plain within 10 miles of North Carolina. The species has been known southward to the mountains of North Carolina and Kearney found it at Virginia Beach; but at our station in Princess Anne Co. it was growing beneath *Cladium jamaicensis* and *Smilax laurifolia* and associated with many other southern, rather than northern types.

Lysimachia quadrifolia L. Occasional in woods: Virginia Beach, no. 4125.

Polypremum procumbens L. Occasional in damp sand or clay: Cape Henry, no. 4130; North Landing, *F. & G.*, no. 2875.

Sabatia brachiata Ell. Local: dry, mixed woods, Little Neck, no. 4134.

An extension north from North Carolina.

S. angularis (L.) Pursh. Frequent in woods, thickets and clearings, very showy in late July and early August: Virginia Beach, no. 4132.

S. gracilis (Michx.) Salisb. Swales back of the dunes, Rifle Range, south of Rudy Inlet, no. 4133.

As pointed out in Rhodora, xxxiv, 27, *Sabatia gracilis* is a southern species, heretofore known north to eastern North Carolina. It is quite distinct from the inland and northern *S. campanulata* (L.) Torr., with which it has been confused.

Bartonia virginica (L.) BSP. Apparently local: damp sandy and peaty depressions back of the dunes, Rifle Range, no. 4136.

Gentiana parvifolia (Chapm.) Britton. Local: with the last, no. 4135.

Asclepias tuberosa L. Common, very conspicuous in June, in clearings and open areas: Creed's, no. 4139. Forma flavescens Farwell. Local: Blackwater River, no. 4140.

Asclepias lanceolata Walt., var. **paupercula** (Michx.), comb. nov. *A. paupercula* Michx. Fl. Bor.-Am. i. 108 (1803).

Assuming that Walter's *Asclepias lanceolata* is the plant with the median leaves lanceolate (Walter's types are so fragmentary that the lower and middle portions of large plants are rarely preserved), the plant of Princess Anne and Norfolk Counties is chiefly var. *paupercula*, which has all the leaves very narrowly elongate-linear ("foliis longissime linearibus"—*Michx.*). We collected the lanceolate-leaved *A. lanceolata* in the brackish marsh of Back Bay, east of Morse Point in Currituck Co., North Carolina (no. 4142). Typical *A. lanceolata* extends north to New Jersey and south to Florida. Most specimens before me do not specify the habitat. One from Miami, Florida (*Garber*) is from "Everglades," one from near Elizabeth City, North Carolina (*Biltmore Herb.*, no. 1415c) is said to be from "Wet pine barrens;" Wiegand & Manning's no. 2596 is from "River swamp" west of Leechville, North Carolina, which is on the estuary of Pungo River; our collection (see above) is from border of salt marsh; and Stone thus summarized the situation in New Jersey: "Though said in the books to be a plant of 'wet pine barrens' it is, so far as New Jersey is concerned, strictly confined to the edge of the salt marshes, where they join the upland" (Stone, Pl. So. N. J. 650 (1911)). May not the difference in habitat be largely associated with the breadth of leaf?

Our three collections of var. *paupercula* are all from acid peat: swales back of the dunes, Rifle Range, south of Rudy Inlet, Princess Anne Co., no. 4141; wet peaty clearings in woods of *Pinus serotina*, south of Grassfield, Norfolk Co., no. 4143; boggy swale by Northwest River, Northwest, *F. G. & L.*, no. 4691 (transitional). There is an old specimen of it in the Gray Herbarium from Norfolk (*J. D. Dana*). As represented in the Gray Herbarium, var. *paupercula* reaches its northern limit in southeastern Virginia; we have it from South Carolina and Georgia ("moist pine-barrens," Sumter Co., *Harper*, no. 1041), with many sheets from Florida, thence to southeastern Texas. Only a few specimens from Florida show indication of habitat and those from Mississippi, Louisiana and Texas give no such data. The Florida specimens which give clues to habitat are from Lake Co., near the geographic center of the state; from "swaley woods," Waldo (in the interior); "around ponds," Myers; "pond-margin," Chipley; "cypress swamp," Fort Myers; "swampy pine barrens," near Jacksonville. It is reasonably clear, then, that typical *A. lanceolata* prefers brackish to saline habitats, var. *paupercula* those which are acid.

A. VERTICILLATA L. Local: dry, mixed woods, Little Neck, no. 4144.

DICHONDRA REPENS Forst., var. CAROLINIENSIS (Michx.) Choisy. Frequent in grasslands: open clay at border of woods, east of Little Neck, no. 4146.

CONVOLVULUS SEPIUM L., var. **Catesbeianus** (Pursh), comb. nov. *Calystegia Catesbeiana* Pursh, Fl. Am. Sept. ii. 729 (1814). VIRGINIA: thickets and woods, Dam Neck, Princess Anne Co., no. 4147.

Var. *Catesbeianus* is the coastal variety (Cape Cod to Florida) with narrowly oblong to lanceolate, long-acuminate, sagittate leaves. It may be pubescent or glabrate and sometimes quite glabrous. Its very narrow and long-acuminate leaves at once distinguish it from var. *pubescens* (Gray) Fern. and from var. *americanus* Sims (the common American plant with glabrous stems and leaves and roseate flowers).

CUSCUTA POLYGONORUM Engelm. On *Cassia*, border of pines, near Princess Anne Courthouse, *F. & G.*, no. 2879.

C. CORYLI Englem. On various herbs, damp woods, Virginia Beach, no. 4149.

HELIOTROPIUM CURASSAVICUM L. Brackish places: Wachapreague, no. 4151; Kempsville, *F. & G.*, no. 2880.

LIPPIA NODIFLORA (L.) Michx. Brackish to fresh sands and ditches by Back Bay, northern end of Knott's Island, no. 4154.

SCUTELLARIA OVALIFOLIA Pers. Dry, mixed woods, seen several times: Little Neck, Princess Anne Co., no. 4160.

Primarily a species (*S. pilosa* Michx., not Hill) of the richer interior, on Little Neck, Great Neck and neighboring areas of rich woodland forming one of an assemblage of isolated piedmont species.

Pycnanthemum incanum Michx., var. **Loomisii** (Nutt.), comb. nov. *P. Loomisii* Nutt. in Journ. Acad. Sci. Nat. Philad. vii. 100 (1834). Virginia: Emporia, Greenville Co., *Tidestrom*, no. 6887; border of wet woods near Great Bridge, Norfolk Co., no. 4162.

Var. *Loomisii* is the southern extreme of *Pycnanthemum incanum* with the pubescence of branches and bracts reduced to a mere white-pruinose or white-puberulent coat, whereas typical *P. incanum* has the branches and, more or less, the bracts short-villous or pilose. Var. *Loomisii* has the pubescence of *P. albescens* Torr. & Gray and closely resembles that species but its calyx-lobes are sharp and setose, those of *P. albescens* blunt and without setae. Var. *Loomisii* is in the Gray Herbarium from New Jersey, Delaware, Virginia, North and South Carolina, Georgia and Alabama.

Physalis pubescens L. Infrequent in dry, sandy woods: Knott's Island, no. 4167; Sand Bridge, no. 4168.

Tentatively placed here; the entire group needs intelligent checking with the types.

Petunia parviflora Juss. Brackish sand, upper border of salt marsh, Wachapreague, Accomac Co., no. 4169.

Apparently indigenous, possibly adventive; an extension northward of the natural range, from Florida.

Mimulus alatus Ait. Occasional in swampy woods: Munden, no. 4186.

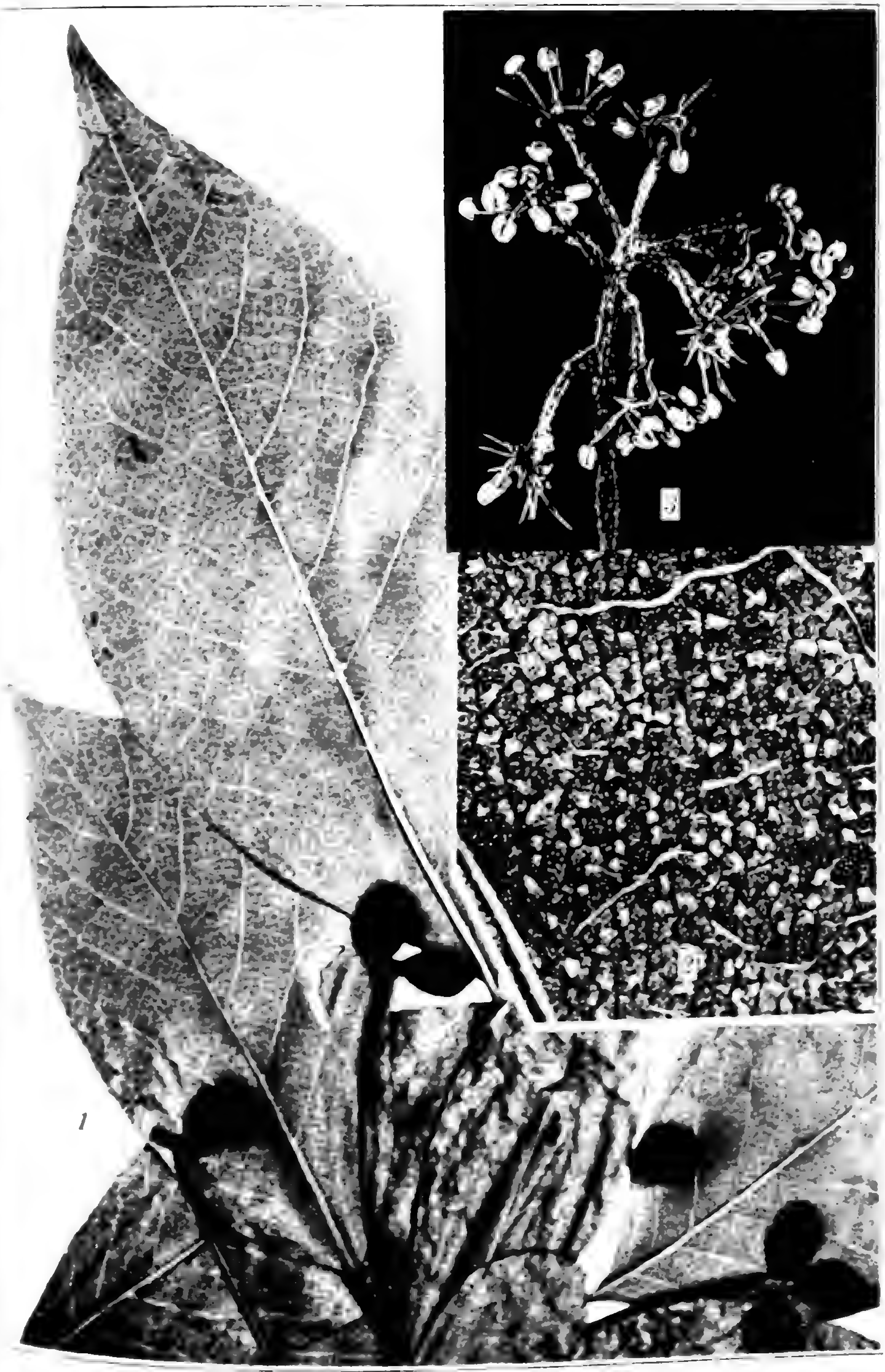
Limosella subulata Ives. Wet sand of dune-hollows, south of False Cape, Princess Anne Co., no. 4180.

Apparently the first recorded station south of New Jersey, southeastern Pennsylvania and the head of Chesapeake Bay in Maryland. The station is so close to the North Carolina line that search will doubtless extend the species into the "southern flora."

Bacopa Monnieria (L.) Wettst., var. **cuneifolia** (Michx.), comb. nov. (plate 401, figs. 1–4 and 7). *Moniera cuneifolia* Michx. Fl. Bor.-Am. ii. 22 (1803). Virginia: damp sand and clay back of the ponds, Dam Neck, Princess Anne Co., no. 4183; wet sand of dune-hollows, south of False Cape, Princess Anne Co., no. 4184 (prostrate and repent); inundated swales back of the dunes, south of False Cape, no. 4185 (erect or sub-erect, up to 3 dm. high).

Typical *Bacopa Monnieria*[1] of pantropical range is smaller (figs. 5

[1] I am spelling the specific name *Monnieria*, not *monnieri*, since the evidence indicates that the latter spelling, though originally used by Linnaeus, was a typographic or orthographic error. As a specific name it started in one of the Linnean Dissertations as LYSIMACHIA (*monnieri*), Cent. II. Pl. 9 (1756). These dissertations were edited, slightly revised and reprinted in Amoenitates Academicae. Centuria II, Plantarum was no. lxiii in Amoen. Acad. iv. pp. 297–332, and there the plant under discussion appeared as GRATIOLA (*monnieria*), with some alterations in the



o. E. C. Ogden.

NYSSA SYLVATICA, var. CAROLINIANA: FIG. 1, fruiting branch, × 1; FIG. 2, papillate
er surface of leaf, × 10; FIG. 3, staminate inflorescence, × 3.

Photo. E. C. Ogden.

Bacopa Monnieria, var. cuneifolia: figs. 1 and 2, summits of erect plants × 1; figs. 3 and 4, flowers, × 3; fig. 7, terminal leaves, × 3.
B. Monnieria: fig. 5, plant, × 1; fig. 6, fruit.

and 6), forming close carpets, the larger sepals lanceolate to lance-ovate and 1.5–2.5 mm. wide. Var. *cuneifolia*, originally from South Carolina, is typical on the coast from Georgia to southeastern Virginia, also Bermuda, and locally in the West Indies, extending thence west to Texas; it also occurs in Hawaii. It is the coarsest extreme of the species, the larger sepals ovate and 3–5 mm. broad.

It seems to me wiser to retain *Bacopa* Aublet (a *nomen conservandum*) for *Moniera* P. Br. or *Herpestis* Gaertn. f. in the inclusive sense of Bentham, Gray, Wettstein, Chodat, Edwall, Standley and others, rather than to follow Pennell in recognizing the sections and subsections as "genera." *Bacopa Monnieria* belongs to Bentham's (and Gray's) *Herpestis* § *Bramia*, to Wettstein's *Bacopa* § *Bramia*. Treated by Pennell[1] as a genus, with the floral characters already well known to Bentham, Gray and Wettstein and evaluated by them as sectional only, *Bramia* is further defined by Pennell with minor vegetative characters which are certainly not generically diagnostic: "Extensively repent" (clearly not in FIGS. 1 and 2); "Stem glabrous" (surely not a character of profound phylogenetic importance); "leaves spatulate-oblong, with one evident longitudinal nerve" (but deep in the tissue of the fleshy—halophytic—leaf there may be additional nerves), "Sepals acute or acutish, much exceeding the acute capsule" as opposed to "Sepals obtuse, scarcely longer than the rounded capsule" in *Ranapalus* or *Bacopa rotundifolia* (Michx.) Wettst. *Bacopa Monnieria* var. *cuneifolia*, included by Pennell under *Bramia* with "Sepals acute or acutish" may have them decidedly obtuse, as in FIGS. 3 and 4. *Bramia* and *Ranapalus* come in Pennell's treatment under a division including "Leaves . . . very entire," as opposed to "Leaves . . . crenate." If *entire* is an adjective which may have varying

citations. Subsequently, in Species Plantarum, ed. 2, i. 24 (1762), it appeared as *G. Monnieria*, and this spelling and capitalization were maintained by Linnaeus in Species Plantarum, ed. 3 (1764) and in his Systema Naturae, ed. 13, ii. 61 (1770). The same spelling (*Monnieria*) was maintained by Murray, Willdenow and other editors of the Linnean works. In Syst. Nat. ed. 10, ii. 851 (1758–59) it appeared as *G. Monnieri. A.*; and this spelling reappeared in ed. 11 (1760); it seems to to have been omitted from ed. 12, but in ed. 13, as already noted, it was *G. Monnieria*. Richter, in his monumental Codex Botanicus Linnaeanus, maintained *G. Monnieria* and specially designated the spelling *Monnieri* as a typographical error ("Gr. Monnieri, *ex err. typ.*"). It should be clear that, although bungling the name (which had been a generic name of Patrick Browne), Linnaeus, in his more mature and careful work (Syst. ed. 10 being in many ways carelessly edited) settled upon *Monnieria* as the preferred spelling; and since his later editors and commentators also adopted this spelling and looked upon *monnieri* and *Monnieri* as typographic errors, it is better so to consider them. I am indebted to Dr. Barnhart for his kindness in sending me transcripts from the original Dissertation, Cent. II. Plantarum.

[1] Pennell, *Scrophulariaceae of the Southeastern United States*, Contrib. N. Y. Bot. Gard. no. 221, Proc. Acad. Nat. Sci. Phila. lxxi. 228, 229 (1920).

degrees, "very" entire is an unfortunate description of leaves which may often be like those shown in fig. 7 (from *Harper*, no. 1826, specially designated in the Gray Herbarium by Pennell as *Bramia*).[1]

Bacopa acuminata (Walt.) Robinson. Occasional in depressions and damp sands: Rosemont, no. 4181; Rifle Range, no. 4182.

Gratiola pilosa Michx. Frequent in depressions, damp sands and swales: Rosemont, no. 4173; Rifle Range, nos. 4174, 4175; False Cape, no. 4172.

Utricularia geminiscapa Benj. Shallow pools in pinelands, Cape Henry, no. 4187.

U. subulata L. Damp sands and peats, Princess Anne Co.: Cape Henry, no. 4188, also *F. & G.*, no. 4502.

Phryma Leptostachya L., var. **confertifolia**, var. nov. (tab. 402, fig. 1), internodiis plerumque abbreviatis 0.4–1.5 cm. longis valde cinereo-pilosis; foliis subgriseis subtus puberulis apice vix prolongatis dentibus marginalibus simplicibus crenatis brevibus.—Virginia: dry, mixed woods, Little Neck, Princess Anne Co., August 8 and 9, 1924, *Fernald & Long*, no. 4197 (type in Gray Herb.); rich, deciduous woods, east of Little Creek, Princess Anne Co., July 31, 1934, no. 4196.

Typical *Phryma Leptostachya* has the internodes elongate, the pairs of leaves standing distinctly apart, the stems less pubescent, the leaves (fig. 2) bright-green and only sparingly pubescent, their tips sharply acuminate or prolonged, and their usually double marginal teeth much prolonged. Var. *confertifolia*, on account of the shortening of the internodes, gives the appearance of having the bluntish or

[1] Restoring the material of *Bacopa* in the Gray Herbarium to that genus, I find it necessary to make the following combinations:

Bacopa acuminata (Walt.) Rob., var. **microphylla** (Raf.), comb. nov. *Ambulia rigida* Raf., var. *microphylla* Raf. Aut. Bot. 43 (1840). *Mecardonia acuminata brevifolia* Pennell, Proc. Acad. Nat. Sci. Phila. lxxi. 237 (1920). *M. acuminata microphylla* (Raf.) Pennell, Torreya, xxii. 79 (1922).

B. acuminata (Walt.) Rob., var. **peninsularis** (Pennell), comb. nov. *Mecardonia acuminata peninsularis* Pennell, Proc. Acad. Nat. Sci. Phila. lxxi. 237 (1920).

In 1930 Pennell marked the material in the Gray Herbarium *Mecardonia acuminata peninsularis;* in 1931 he assigned it to the genus *Pagesia*, but he left typical *Bacopa acuminata* and var. *microphylla* in the genus *Mecardonia.*

B. procumbens (Mill.) Greenm., var. **peduncularis** (Benth.), comb. nov. *Herpestis peduncularis* Benth. in Hook. Comp. Bot. Mag. ii. 56 (1836). *H. chamaedryoides*, var. *peduncularis* (Benth.) Gray, Syn. Fl. N. Am. ii[1]. 280 (1878). *Mecardonia peduncularis* (Benth.) Small, Fl. Se. U. S. 1065, 1338 (1903).

B. procumbens (Mill.) Greenm., var. **tenuis** (Small), comb. nov. *Mecardonia tenuis* Small, Fl. Se. U. S. 1065, 1338 (1903).

Although Pennell maintained this as a species he characterized *Mecardonia tenuis* as "so close to *M. procumbens* and to *M. peduncularis* (Benth.) Small of Texas that the actual relationship of these species should be more fully investigated in the field" (Proc. Acad. Nat. Sci. Phila. lxxi. 238 (1920)). Asa Gray better understood it (Syn. Fl.) when he said of it under *Herpestis procumbens*, var. *peduncularis:* "A similar form, but with diffuse or procumbent stems (*H. peduncularis*, Chapm. Fl. 291), is from Key West, Florida."

merely acute gray-green leaves subverticillate. No typical *P. Leptostachya* was seen on the coastal plain of Virginia.

Galium obtusum Big., var. **filifolium** (Wiegand), comb. nov. *G. tinctorium filifolium* Wiegand in Bull. Torr. Bot. Cl. xxiv. 397 (1897). *G. filifolium* (Wiegand) Small, Man. 1208 (1933).—Frequent in damp woods about Virginia Beach, no. 4202, also *F. G. & L.*, no. 4704.

In his very helpful study[1] of *Galium trifidum and its North American Allies* Wiegand clearly differentiated several plants which had previously been confused under *G. trifidum;* but, although he said of *G. trifidum,* as well as of some of the other names involved, "It is necessary first of all to determine just what plant this name represents," he contented himself with a discussion of the interpretations of various post-Linnean authors, without recording any effort to see exactly what Linnaeus had before him. In the cases of *G. trifidum* L. Sp. Pl. 105 (1753) and *G. tinctorium* L. l. c. 106 (1753) the types are perfectly clear; both were collected by Kalm, the first in "Canada," the second in "North America." Happily, Wiegand's deduction regarding the identity of *G. trifidum* was correct; a beautiful photograph of the Kalm sheet (the type) sent me from the Linnean Herbarium by Mr. S. Savage is a most characteristic specimen of the plant, with long arcuate peduncles, now properly passing as *G. trifidum.*

In the other case, however, that of *Galium tinctorium,* I am unable to follow Wiegand's reasoning when he writes of it, "From the description given by Linnaeus one can scarcely tell which plant is meant," for to me the Linnean diagnosis of Kalm's specimen (from Eastern America, probably Crown Point, New York, at the foot of Lake Champlain) is definite: "foliis linearibus: caulinis senis; ramorum quaternis, caule flaccido, pedunculis subbifloris, fructibus glabris." In spite of the clear statement by Linnaeus that the linear cauline leaves were in 6's, those of the branches in 4's, and the stems flaccid, Wiegand applied the name *G. tinctorium* to *G. obtusum* Bigelow and defined it as "rather stiff, . . . branches . . . strict, . . stem glabrous or nearly so; leaves commonly in 4's, . . . corolla white, large (2–3½ mm. diam.), 4-parted"; while he called the small-flowered and weaker plant with primary leaves in 6's *G. Claytoni* Michx., well characterized by Wiegand: "stem slender . . . [with] diffuse branches . . . ; leaves . . . commonly in 5's or 6's, . . . flowers in clusters of 2's or 3's, . . . corolla minute, white, 3-parted."

[1] Wiegand, Bull. Torr. Bot. Cl. xxiv. 389–403 (1897).

As a synonym of his *Galium Claytoni* Wiegand cited "*G. tinctorium* Bigelow, Fl. Bost. ed. **2,** 54. 1824." Having learned to have a keen respect for the precision of Jacob Bigelow, who with John Torrey early shared distinction as an accurate American phytographer, I have turned to Bigelow's accounts. After giving a clear English version of the Linnean diagnosis of *G. tinctorium* Bigelow added his own:

> A weak, branching plant, rough with reflexed prickles. Leaves linear-lanceolate, obtuse, whorled, the larger ones in sixes, smaller ones in fours. Peduncles very small, supporting minute white flowers.

Bigelow's account was so like the Linnean diagnosis of *Galium tinctorium* that it is not easy to see why his plant should be treated as identical with *G. Claytoni* Michx., if the Kalm plant (type of *G. tinctorium*) is not also *G. Claytoni*. That Bigelow clearly understood the two species, subsequently again differentiated by Wiegand, is evident. His *Galium obtusum* was thus defined:

> *G. caule laevi, procumbente; foliis quaternis, oblanceolatis, obtusis, margine nervoque asprellis; fructu laevi.*
>
> Stem smooth, procumbent; leaves in fours, oblanceolate, obtuse, rough on the edge and midrib; fruit smooth.
>
> Stem slender, diffuse, much branched, quadrangular, entirely smooth. Leaves universally in fours, linear-lanceolate, very obtuse, a little rough at the midrib and margin. Peduncles slender, three flowered. Petals acute, white. Fruit globular, smooth.—On the banks of Muddy brook, Roxbury.—July.—Perennial.

Further indicating his correct understanding of the two species, Bigelow added the comparative note: "It is a larger and more open plant than G. tinctorium." Every one who knows the type-region of *G. obtusum* and the abundant specimens from there in the local herbaria will agree with Wiegand that the plant which, in 1897, he called *G. tinctorium* is unquestionably *G. obtusum* Bigel.

Since American botanists have been following Wiegand in treating the partly 6-leaved flaccid *G. tinctorium* of Linnaeus as a stiffer plant with "leaves commonly in 4's," it seemed important to settle the exact identity of Kalm's material which is the type of *G. tinctorium.* Fortunately, the sheet in the Linnean Herbarium is well preserved (obviously not much studied in the past!) and a portion of the photograph of it, which Mr. Savage sends, is here reproduced, life-size, as PLATE 403, FIG. 1. Beside it, for comparison, is a portion of a plant (FIG. 2) farther advanced but still with some ascending flowers (the specimen from Conquest, New York, *Wiegand*, no. 7172) of the plant which Wiegand has removed from his own *G. tinctorium* and called *G. Claytoni.* Further to clarify the situation, FIG. 3 is a flowering fragment, × 1, of the 4-leaved plant which Wiegand thought was meant as *G. tinctorium* by Linnaeus, the plant which had been properly separated from true *G. tinctorium* by Bigelow as *G. obtusum.*

That *G. tinctorium* L. is the small-flowered plant with leaves often in 6's, as originally described, seems perfectly clear; and that it is also *G. Claytoni* Michx. is sufficiently demonstrated by a fragment of Michaux's type long ago presented to Asa Gray and now preserved in the Gray Herbarium.

I have suggested that the type of *Galium tinctorium* came from Crown Point on Lake Champlain. Linnaeus had his material from Pehr Kalm who, on July 8, 1749, wrote of it from "Fort St. Frederic, welches von den Engländern Crownpoint genannt wird":

> *Vom achten.* Das *zum Färben dienliche Meyerkraut** wurde in dem ganzen Canada von den Franzosen *Tisavojaune rouge* genannt, und wuchs hier in Menge in den Wäldern, und liebte eine gute Gartenerde, die fast etwas feuchte war. Mit den Wurzeln hiervon gaben die Wilden den Stacheln der Amerikanischen Igeln [quills of the American porcupine], welche sie in verschiedene Arbeiten einflechten, die rothe Farbe; und wird dieselbe schwerlich von der Sonne, dem Wasser oder der Luft verandert. Die Französischen Frauensleute in Canada sollen auch ihre Kleider mit diesen Wurzeln, welche klein, als bey dem gelben *Meyerkraute* (*Galium luteum*) sind, roth färben.—Kalm, Reise, iii. 303, 304 (1764).
>
> *Galium (tinctorium) foliis linearibus, caulinis senis . . . *Linn. Sp. pl.* 106.

If any further evidence were needed as to what Kalm (and after him Linnaeus) meant it could be found in Kalm's statement that his *Galium tinctorium* grew in all of Canada (in dem ganzen Canada), for the tiny-flowered plant with the leaves of the primary axes usually in 6's is superabundant in the Province of Quebec (Canada of Kalm); the stiffer plant with larger leaves in 4's and with large flowers is very local in Quebec, found only in the southwest corner of the Province. In the Gray Herbarium there are 10 sheets of true *G. tinctorium* (*G. Claytoni*) from the portion of Canada known to Kalm; but the two sheets of *G. obtusum* from the Province are both from the vicinity of Montreal.

N. B. The above and other similar cases emphasize the absolute necessity of getting back to the actual types when possible.

Galium triflorum Michx., var. **asprelliforme**, var. nov. (tab. 404, fig. 1), inflorescentia paniculata laxe ovoidea vel ellipsoidea foliorum verticellis superioribus valde reductis, ramis floriferis elongatis paniculato-ramosis plerumque 3–8-nodatis foliis 3–10 mm. longis.—Southern and western New England and New York to northern Florida and Tennessee. Type: border of wet woods near Great

Bridge, Norfolk Co., Virginia, August 4 and 5, 1934, *Fernald & Long*, no. 4205 (in Gray Herb.).

Typical *Galium triflorum* Michx. "pedunculis lateralibus et terminalibus verticillato longioribus, trifloris," originally from "umbrosis Canadae sylvis," occurs in southern Greenland and generally from Newfoundland to southern Alaska, southward into the wooded areas of the northern United States, thence to the uplands of Virginia and, sparingly, Tennessee, northern Louisiana, Texas and Mexico; it is also in northern and mountainous areas of Eurasia in quite typical form (fig. 2), with the upper leaves but slightly reduced and the peduncles short and terminally 3-flowered or 3-forked. In southern and western New England and in southern and central New York var. *asprelliforme* is occasionally found, especially in warm areas, and southward it largely takes the place of the typical northern plant. All the material in the Gray Herbarium from Florida, the Carolinas and the coastal plain of Virginia belongs to var. *asprelliforme;* and most of that from Tennessee and Kentucky is either the variety or strongly transitional to it. The name is selected because, in the herbarium, the variety has been repeatedly placed under *G. asprellum* Michx.

G. uniflorum Michx. Occasional: rich deciduous woods, east of Little Creek, Princess Anne Co., no. 4207; Great Neck, *F. G. & L.*, no. 4702; Sigma, *F. G. & L.*, no. 4703.

The first from north of South Carolina.

Viburnum scabrellum (T. & G.) Chapm. Border of oak woods, north of Seatack, no. 4212.

Melothria pendula L. Wet sandy woods, northern end of Knott's Island, Princess Anne Co., no. 4213; and seen, occasionally, at other places.

Lobelia Nuttallii R. & S. Local: damp sandy and peaty depressions back of the dunes, Rifle Range, no. 4214.

Vernonia glauca (L.) Willd. Rich deciduous woods, east of Little Creek, no. 4215; and seen elsewhere in northern Princess Anne Co.

A species of the rich interior, apparently isolated and very unusual on the coastal plain.

Eupatorium cuneifolium Willd. Wet, peaty clearings in woods of *Pinus serotina*, south of Grassfield, Norfolk Co., no. 4223.

Apparently an extension north from South Carolina; var. *semiserratum* (DC.) Fern. & Grisc. is frequent or common.

Mikania scandens (L.) Willd., var. pubescens (Muhl.) T. & G. Inundated swale back of the dunes, south of False Cape, Princess

Photo. E. C. Ogden.

PHRYMA LEPTOSTACHYA, var. CONFERTIFOLIA: FIG. 1, plant (TYPE), × 1.
P. LEPTOSTACHYA: FIG. 2, characteristic leaf, × 1.

Photo. E. C. Ogden.

Galium tinctorium: fig. 1, portion of type in Linnean Herbarium, × 1, from photograph supplied by Mr. S. Savage; fig. 2, flowering branch, × 1, of *G. Claytoni.*
G. obtusum: fig. 3, flowering branch, × 1.

Anne Co., no. 4229; seen in abundance on the brackish to salt marshes along the causeway leading from Munden to Knott's Island.

In Princess Anne Co., *Mikania scandens* of fresh marshes and thickets had membranaceous and prolonged leaves and lilac flowers, like the plant extending into New England. Var. *pubescens* had milk-white flowers and seemed to be confined to brackish or saline habitats; its leaves, in the only collection we made, are like those of the essentially southern variety in being fleshy and scabrous, the pubescence not always abundant. The leaves of the variety are broader or more rounded-ovate than in most northern material. Var. *pubescens* is represented in the Gray Herbarium northward to Burlington Co., New Jersey.

SOLIDAGO PUBERULA Nutt., var. PULVERULENTA (Nutt.) Chapm. (*S. pulverulenta* Nutt.). Apparently local: border of swamp, Pungo Causeway (mixed with typical S. PUBERULA), *F. & G.*, no. 2944 (in part).

Some of the material quite unlike the usually more northern or inland *Solidago puberula* in having the upper leaves abruptly reduced in size, oblong and blunt. First from north of the Carolinas.

S. ERECTA Pursh. Common in dry soil: Cedar Hill, *F. & G.*, no. 2939; Cape Henry, *F. & G.*, no. 2940.

S. SEMPERVIRENS L., var. **mexicana** (L.), comb. nov. *S. mexicana* L. Sp. Pl. ii. 879 (1753). Brackish shores, common: Kempsville, *F. & G.*, no. 2941.

Typical *Solidago sempervirens* abounds from the Gulf of St. Lawrence and the lower River St. Lawrence to southern New York and New Jersey, but south of New Jersey it occurs only locally to Virginia. Its fleshy leaves are quite smooth, without ciliolate margins, the lower leaves oblanceolate to spatulate-oblong and 1.2–7 cm. broad, its cauline leaves oblanceolate to lanceolate. The branches of its panicle are usually quite glabrous and the hemispherical heads are very large, with involucres 4–7 mm. high, while its flowers are large for the genus: pappus 3.5–5.5 mm. long; disk-corollas 4–5.5 mm. long; mature achenes 2.2–3.5 mm. long. In subtropical America, extending north on the Atlantic coast to southern New York and locally to southeastern Massachusetts, *S. mexicana* is at once distinguished by its narrower leaves and smaller heads. The basal leaves are linear- to oblong-lanceolate, rarely 3 cm. broad; the cauline linear-lanceolate and often quite acute, frequently ciliolate. The branches of the panicle are often hirtellous and the heads are mostly smaller than in the better developed *S. sempervirens*. I am, however, unable to separate the two as species.

As geographic varieties they are pronounced and in the more fleshy and broader leaves and quite glabrous foliage and branches the northern *S. sempervirens*, var. **typica** (*S. sempervirens* L. Sp. Pl. ii. 878 (1753)) reflects its concentration on the outer saline coast. Var. *mexicana*, with narrower and less fleshy leaves inclined to be scabrous-ciliolate and with hirtellous branches, shows a response to less saline conditions. Its habitats (at least northward) are inclined to be more brackish or inland than strongly saline or on the outermost coast, as indicated by the labels which give sufficient data: brackish marshes, Princess Anne Co., Virginia; Norfolk, Virginia; Queen's Creek, north of Williamsburg, Virginia; Curtis Bay, Anne Arundel Co., Maryland; along Gunpowder River, Maryland; sandy river-shore, Newcastle, Delaware; bank of Hudson R., Fishkill Landing, New York; shore of Lagoon Pond, Tisbury, Massachusetts; dry field at 100 feet elevation, north of Wakebee Pond, Mashpee, Massachusetts; open hillside, two miles from shore, north of Centreville, Massachusetts.

Much of the southern material of var. *mexicana* has been misidentified as *S. petiolata* Mill. (*S. stricta* Ait.; *S. angustifolia* Ell.). *S. petiolata*, however, has a stoloniferous base, very reduced upper cauline leaves and quite glabrous inflorescences.

S. pinetorum Small. Occasional in dry soil: Barney's Corner, Princess Anne Co., no. 4234. Represented in the Gray Herbarium from Henrico Co. (West Hampton, *Randolph & Merriman*, no. 271) and from Pittsylvania Co. (Fall Creek, *Heller*, no. 1112), both distributed as *S. juncea* Ait.

Solidago pinetorum replaces *S. juncea* on the southeastern coastal plain, extending into the piedmont. It is quickly distinguished by its "triple-nerved" leaves, the basal only 5–17 mm. broad, its smaller heads and its glabrous or glabrate achenes. It was, apparently, included by Nuttall in his complex *S. missouriensis*, on account of the triple-nerved leaves: "Hab. Missouri, Arkansas, the Rocky Mountains, and near Chapel-Hill, North Carolina."—Nutt. Trans. Am. Phil. Soc. v. 327 (1837). The western and inland *S. missouriensis*, however, has abundant slender stolons, none of the material of *S. pinetorum* showing any tendency to produce them. *S. pinetorum* was thought by Kearney in 1901 to be an undescribed species; but, unfortunately, the species cannot now take his name: "**Solidago** sp. nov.? . . . Edenton, N. C., July 30 (Nos. 1897, 1900). Leaves distinctly triple-nerved; species intermediate between *S. juncea* Ait. and *S. missouriensis* Nutt."

S. tortifolia Ell. Local: depressions in clay fields, Rosemont, no. 4233.

ASTER UNDULATUS L. Infrequent: dry oak woods, Cape Henry, *F. & G.*, no. 2917.

ERIGERON PUSILLUS Nutt. Abundant in sandy soil: Cape Henry, *F. & G.*, no. 2915; False Cape, *F. G. & L.*, no. 4708.

PLUCHEA PETIOLATA Cass. Brackish marsh by Thurston Brook, Smith's Corner, Princess Anne Co., nos. 4248, 4249.

ANTENNARIA PARLINII Fern. Locally in borders of rich woods: Little Neck, no. 4240; Great Bridge, *F. & G.*, no. 4514.

A. FALLAX Greene. Local, at borders of rich woods: Little Neck, no. 4238.

A. SOLITARIA Rydb. Local, with the two preceding on Little Neck, no. 4239.

Chiefly a species of the interior. One of Clayton's specimens (his no. 287) of *A. solitaria*, from somewhere in Virginia, was included by Linnaeus under his *Gnaphalium plantaginifolium.*

GNAPHALIUM (§ GAMOCHAETA) **calviceps,** sp. nov. (TAB. 405, FIGS. 1–4), bienne; foliis rosulatis juvenilibus spathulato-oblanceolatis obtusis apice apiculatis brevissime pannoso-tomentulosis 1.3–4 cm. longis 0.6–1.2 cm. latis; caulibus subsimplicibus vel plerumque ramosis 1–2.5 dm. altis, ramibus valde adscendentibus gracilibus sericeis; foliis caulinis lineari-oblanceolatis falcatis apice acutis vel attenuatis subulato-mucronatis sericeo-tomentulosis imis 2.5–4 cm. longis 3–5 mm. latis, superioribus valde reductis glomerulis brevioribus vel eas paulo superantibus lineari attenuatis; capitulis stramineis glomerulatis glomerulis distantibus spicam interruptam gracilem 0.5–1 cm. crassam formantibus; involucris 3–4 mm. altis glabris vel subglabris basi vix lanatis; bracteis ca. 10, lineari-oblongis exterioribus subacutis interioribus obtusis 0.5 mm. latis; floribus fertilibus 5–6, imperfectis 12–15 ca. 4 mm. longis; achaeniis oblongis 0.5 mm. longis; pappi setis 12–15 longe barbellulatis 2–2.5 mm. longis; receptaculis denudatis planis papillatis.—VIRGINIA: sandy pinelands, The Desert, Cape Henry, July 28 and 29, 1934, *Fernald & Long*, no. 4245 (TYPE in Gray Herb.); dry open clay lands, Virginia Beach, July 27, 1934, *Fernald & Long*, no. 4244, June 21, 1935, *Fernald, Griscom & Long*, no. 4710.

It is with great hesitation that I propose another species of *Gnaphalium* § *Gamochaeta*, especially since the revision of the group in the Gray Herbarium and the publication by Dr. I. M. Johnston of six new species[1] of the section from Mexico. *G. calviceps*, however, stands apart from the other members of the group described from North America in so many characters that I am unable to identify it with any of them; nor can I match it even approximately with South American and Old World plants. When a detailed study of the entire group, with full knowledge of the types, can be made it may find a

[1] Johnston, Contrib. Gray Herb. lxviii. 98–101 (1923).

place under an already described species. The nearest allies, as I understand them, of *G. calviceps* are *G. falcatum* Lam., originally from Uruguay but extending north on coastal sands to South Carolina, and *G. pedunculosum* Johnston, of south-central Mexico.

Gnaphalium falcatum (fig. 5), however, is loosely tomentose; the leaves bluntly mucronate (fig. 7); the inflorescence thicker and more crowded, with prolonged leafy bracts with the larger involucres densely enmeshed in tomentum (fig. 6), with ovate outer involucral bracts; and with much longer pappus. Contrasted with *G. falcatum*, *G. calviceps* is closely sericeous-pannose or -tomentulose; its leaves (fig. 4) taper to more subulate tips; the open inflorescence has much smaller bracts, and its small involucres (fig. 3) are essentially glabrous except sometimes at base, and the outer bracts are much narrower.

Gnaphalium pedunculosum (fig. 8) has less mucronate leaf-tips (fig. 9); pedunculate, densely leafy-bracted subspherical glomerules, involucres larger (4–5 mm. high) with about 20 bracts, the outer bracts ovate; the flowers 50 or more, 2.5 mm. long; and the pappus-bristles only 6. It is quite unlike *G. calviceps* in all details.

In the region of Cape Henry *Gnaphalium calviceps* occurred with the wholly different *G. purpureum* L. Many plants were over-ripe but others were in fresh anthesis at the end of July (obviously extending into early August). *G. falcatum*, its nearest relative, perhaps, is represented in the Gray Herbarium by material from the sands of South Carolina, thence to Florida and Mississippi. All of it (some fully ripe) from South Carolina and Georgia was mature in April or early May, while that from Florida was collected in February and March. During our trip two strange plants particularly attracted us as very distinct. One was the *Hypoxis* which I have called *H. Longii;* the other the little *Gnaphalium calviceps*, strongly contrasted with *G. purpureum*, with which it was associated. I can appropriately name the first for one of its discoverers; the name of the second sufficiently suggests the other collector.

Polymnia Uvedalia L., var. floridana Blake, Rhodora, xix. 48 (1917). Occasional: dry clay of open woods and thickets, north of Blackwater River, Princess Anne Co., no. 4253.

Our material is a good match for the type, from Brevard Co., Florida. Blake restricted the variety to Florida, but it has a coastal plain dispersal northward to Delaware and westward to Alabama, the coastal plain specimens in the Gray Herbarium from these states and from Virginia (Williamsburg, *Grimes*, no. 4219), South Carolina

Photo. E. C. Ogden.

GALIUM TRIFLORUM, var. ASPRELLIFORME: FIG. 1, flowering plant (TYPE), × 5/12.
G. TRIFLORUM: flowering plant, × 5/12.

Photo. E. C. Ogden

GNAPHALIUM CALVICEPS: FIG. 1, flowering plant (TYPE), × 1; FIG. 2, 1st year's rosette, × 1; FIG. 3, involucres, × 5; FIG. 4, tip of cauline leaf, × 10.
G. FALCATUM: FIG. 5, inflorescence, × 1; FIG. 6, glomerule of involucres, × 5; FIG. 7, tip of cauline leaf, × 10.
G. PEDUNCULOSUM: FIG. 8, inflorescence of TYPE, × 1. FIG. 9, tip of cauline leaf, × 10.

and Georgia all belonging to it; while the plant of the Piedmont and Appalachian region is Blake's var. *genuina*, with very glandular pedicels. Var. *floridana* lacks the abundant glands and has the pedicels pilose-hispid. The material, now more abundant than when he studied it, has the lobes and teeth of the leaves sharper than in var. *genuina*.

SILPHIUM TRIFOLIATUM L. Border of dry, mixed woods, Little Neck, Princess Anne Co., no. 4254, typical form with leaves in 3's; swampy woods, London Bridge, no. 4255 (leaves opposite or alternate). Collected also by Kearney.

A typical plant of the interior, here on the outer coastal plain.

BORRICHIA FRUTESCENS (L.) DC. Upper border of salt marsh, Wachapreague, Accomac Co., no. 4251.

BIDENS VULGATA Greene. Apparently infrequent: ditch near Back Bay, *F. & G.*, no. 2929.

HELENIUM TENUIFOLIUM Nutt. Clay field south of Seatack, no. 4256.

CACALIA ATRIPLICIFOLIA L. Frequent in dry woods and thickets: between Creed's and Back Bay P. O., no. 4258; Little Neck, no. 4259.

HIERACIUM VENOSUM L., var. BLOMBERGII Zahn. Frequent in sandy pinelands: Cape Henry, no. 4261.

EXPLANATION OF PLATES 384–405

PLATE 384. ASPLENIUM PLATYNEURON (L.) Oakes: FIG. 3, mature pinnae, showing confluent sori, × 1, from Little Creek, Virginia, *Fernald & Long*, no. 3602.

A. PLATYNEURON, var. EUROAUSTRINUM, n. var.: FIG. 1, plant, × ⅖, from Munden, Virginia, *Fernald & Long*, no. 3603 (TYPE); FIG. 2, mature pinna, showing remote sori, × 1, from the TYPE.

PLATE 385. SAGITTARIA WEATHERBIANA, n. sp.: FIG. 1, flowering plant and a second inflorescence, × ½, from north of Land of Promise, Virginia, *Fernald & Griscom*, no. 4297 (TYPE); FIG. 2, dilated filaments and long anthers, × 10, from the TYPE; FIGS. 3–6, mature achenes, × 10, from type-station, *Fernald, Griscom & Long*, no. 4536.

PLATE 386. SAGITTARIA WEATHERBIANA, n. sp.: FIG. 1, phyllodia, × 5/12, from Longwood Island, Waccamaw River, South Carolina, *Weatherby & Griscom*, no. 16,395.

S. GRAMINEA Michx.: FIG. 2, anthers, × 2, from Little Meteghan Lake, Nova Scotia, *Fernald & Long*, no. 23,174; FIGS. 3, 4 and 5, achenes, × 10, from Dune Park, Porter Co., Indiana, July 29, —, *D. C. Peattie*.

S. AMBIGUA J. G. Sm.: FIG. 6, stamens, × 10, from Joplin, Missouri, *E. J. Palmer*, no. 2130A; FIG. 7, achene, × 10, from Alba, Missouri, *E. J. Palmer*, no. 3061.

S. CYCLOPTERA (J. G. Sm.) Mohr.: FIG. 8, stamens, × 10, from Myers, Florida, *Hitchcock*, no. 371; FIGS. 9 and 10, achenes, × 10, from Fort Myers, Florida, *J. P. Standley*, no. 121.

S. LANCIFOLIA L.: FIG. 11, stamens, × 10, from Eustis, Florida, *Nash*, no. 124; FIGS. 12 and 13, achenes from Miragoane, Haiti, *Eyerdam*, no. 422.

S. FALCATA Pursh: FIG. 14, stamens, × 10, from Florida, *Biltmore Herb.*, no. 3300ᵃ; FIG. 15, achene, × 10, from Munden, Virginia, *Fernald & Long*, no. 3625.

Plate 387. Eleocharis ambigens, n. sp.: fig. 1, plant, × ⅖, from Dam Neck, Virginia, *Fernald & Long*, no. 3765 (type); figs. 2 and 3, spikelets, × 4, from the type; figs. 4 and 5, summit of sheath, × 10, from type; fig. 6, achene, × 10, from type; fig. 7, achene, × 25, from type; fig. 8, surface of achene, × 50, from type.

E. uniglumis (Link) Schultes: fig. 9, spikelet, × 4, from Anholt, Denmark, July 25, 1897, *Ove W. Paulsen;* fig. 10, summit of sheath, × 10, from same; fig. 11, achene, × 10, from same.

E. halophila Fernald & Brackett: fig. 12, spikelet, × 4, from Bonaventure River, Quebec, August 2–4, 1904, *Collins, Fernald & Pease* (type); fig. 13, summit of sheath, × 10, from type; fig. 14, achene, × 10, from type.

Plate 388. Forms of Fimbristylis puberula (Michx.) Vahl., × 1; all from flats back of the dunes, Rifle Range, south of Rudy Inlet, Virginia, *Fernald & Long:* fig. 4, F. puberula (typical), no. 3746; figs. 1 and 2, forma eucycla, n. f., no. 3750 (type); fig. 3, forma pycnostachya, n. f., no. 3752 (type).

Plate 389. Fimbristylis Baldwiniana (Schultes) Torr.: fig. 1, inflorescence, × 1, from Sand Bridge, Virginia, *Fernald & Long*, no. 3755; fig. 2, spikelet, × 5, of no. 3755; figs. 3 and 4, achenes, × 10, from no. 3757; fig. 5, inflorescence, × 1, from Northwest, Virginia, *Heller*, no. 760; fig. 6, spikelet, × 5, from no. 760; figs. 7 and 8, achenes, × 10, from no. 760; fig. 9, inflorescence, × 1, from Williamson, Pennsylvania, August 19, 1906, *Pennell* (*F. Darlingtoniana* Pennell); fig. 10, spikelet, × 5, from Williamson (*F. Darlingtoniana*); figs. 11 and 12, achenes, × 10, from Williamson (*F. Darlingtoniana*); fig. 13, inflorescence, × 1, from Rosemont, Virginia, *Fernald & Long*, no. 3756; fig. 14, inflorescence, × 1, from Goshenville, Chester Co., Pennsylvania, *Bartram*, no. 1213 (*F. Darlingtoniana*); fig. 15, spikelet, × 5, from no. 1213 (*F. Darlingtoniana*); figs. 16 and 17, achenes, × 10, from no. 1213; fig. 18, inflorescence, × 1, from Florida, *Torrey*, N. Am. Cyp.; fig. 19, spikelets, × 5, from Florida, *Torrey;* figs. 20 and 21, achenes, × 10, from same; fig. 22, inflorescence, × 1, from near Athens, Georgia, *Harper*, no. 68; fig. 23, spikelet, × 5, from no. 68; figs. 24 and 25, achenes, × 10, from no. 68; fig. 26, inflorescence, × 1, from Newcastle Co., Delaware, September, 1872, *Commons* (*F. Darlingtoniana*); figs. 27 and 28, achenes, × 10, from same; figs. 29 and 30, achenes, × 10, from West Chester, Pennsylvania, *Darlington* (*F. Darlingtoniana*); figs. 31 and 32, achenes, × 10, from Northwest, Virginia, *Heller*, no. 1249.

Plate 390. Rynchospora gracilenta Gray: fig. 1, plant, showing all leaves involute-capillary, × ⅖, from Bamber, New Jersey, August 25, 1909, *Bayard Long;* fig. 2, inflorescence, × 2, from same; fig. 3, achene, × 10, from Shark River, New Jersey, September 20, 1861, *Wm. Boott*.

R. gracilenta, var. diversifolia, n. var.: fig. 4, plant, showing flat cauline leaves, × ⅖, from Rifle Range, south of Rudy Inlet, Virginia, *Fernald & Long*, no. 3796 (type); fig. 5, inflorescence, × 2, from type; figs. 6 and 7, achenes, × 10, from type.

Plate 391. Rynchospora axillaris (Lam.) Britton (Schoenus axillaris Lam.): fig. 1, type of *S. axillaris*, × ¾, from photograph sent from Muséum National d'Histoire Naturelle, Paris, by Professor Humbert.

R. cephalantha Gray: fig. 2, inflorescence, × 1, from Pine Barrens of New Jersey, *Torrey* (type); fig. 3, achene, × 10, from type.

R. microcephala Britton: fig. 4, inflorescence (folded back), × 1, from south of Grassfield, Norfolk Co., Virginia, *Fernald & Long*, no. 3785; fig. 5, achene, × 10, from Salisbury, Maryland, September 28, 1863, *Commons*.

Plate 392. Uvularia puberula Michx.: fig. 1, exceptionally small fruit, × 1.8, from Cove Road, Craig Co., Virginia or Monroe or Allegheny Co., West Virginia, *Steele & Steele*, no. 268; fig. 4, flower, showing long style, × 1.8, from White Sulphur Springs, West Virginia, May, 1914, *F. W. Hunnewell;* fig. 5, flower, showing long anthers, × 1.8, from same collection as fig. 4; fig. 7, lower surface of leaf, by reflected light, showing elevated reticulation (with shadows), × 5, from Henderson Co., North Carolina, *Wiegand &*

Manning, no. 856; FIG. 8, reticulation of same leaf (cf. FIG. 6), × 5, by transmitted light.

U. PUBERULA, var. NITIDA (Britton) Fern.: FIG. 2, flower, showing long style, × 1.8, from South Lakewood, New Jersey, *Mackenzie*, no. 4556; FIG. 3, flower, showing long anthers, × 1.8, from Tom's River, New Jersey, May 30, 1907, *Eggleston;* FIG. 6, lower surface of leaf, by reflected light, showing reticulation not elevated (no shadows), from Tom's River, New Jersey, May 31, 1887, *N. L. Britton* (one of original specimens)—cf. FIG. 8.

PLATE 393. HYPOXIS LONGII, n. sp., all figs. from Rifle Range, Virginia, *Fernald & Long*, no. 3862 (TYPE): FIG. 1, fruiting plant, × 1; FIG. 2, flower, × 5; FIG. 3, flower mechanically spread open, × 10; FIG. 4, summit of fruit, × 10; FIG. 5, dehisced fruit, with seeds, × 10; FIG. 6, valves of dehisced capsule, × 10; FIGS. 7 and 8, seeds, × 12.

PLATE 394. CARPINUS CAROLINIANA Walt.: FIG. 1, tip of fruiting branch, × 1, from Rock Bluff, Liberty Co., Florida, *Wiegand & Manning*, no. 972; FIG. 2, bract and fruit, × 2, from no. 972; FIG. 3, bract and fruit, × 2, from Vienna, Johnson Co., Illinois, *Gleason*, no. 2289; FIG. 4, bract and fruit, × 2, from southwest of Five Forks, James City Co., Virginia, *Randolph & Randolph*, no. 411; FIG. 5, bract and fruit, × 5, from Mars Bluff, Florence Co., South Carolina, *Wiegand & Manning*, no. 970; FIG. 6, leaf-margin, × 5, from Ocean Springs, Mississippi, *Tracy*, no. 6892; FIG. 7, leaf-margin, × 5, from Tallahassee, Florida, *Nash*, no. 2340; FIG. 8, leaf-margin, × 5, from near Blackwater River, Virginia, *Fernald & Long*, no. 3894; FIG. 9, leaf-margin, × 5, from Elizabeth City, North Carolina, *Wiegand & Manning*, no. 969; FIG. 10, leaf-margin, × 5, from Gibson, Glascock Co., Georgia, *Harper*, no. 1322.

PLATE 395. CARPINUS CAROLINIANA, var. VIRGINIANA (Marsh.) Fern.: FIG. 1, tip of fruiting branch, × 1, from Franklin, Connecticut, September 16, 1906, *R. W. Woodward;* FIG. 2, bract and fruit, × 2, from Sidney, Maine, *Fernald & Long*, no. 13,443; FIG. 3, bract (transitional) and fruit, × 2, from Gossan, Carroll Co., Virginia, July 12, 1892, *Small;* FIG. 4, bract and fruit, × 2, from Redding, Connecticut, *Weatherby*, no. D2717; FIG. 5, leaf-margin, × 5, from Easton, Pennsylvania, July 15, 1897, *Porter;* FIG. 6, leaf-margin, × 5, from Fayette, Iowa, July, 1894, *Fink;* FIG. 7, leaf-margin, × 5, from Sidney, Maine, *Fernald & Long*, no. 13,443.

PLATE 396. LINUM: plants, × ¾; leaves, × 5; details of leaf-venation, × 10; capsules, × 5; ripe carpels, × 8.

LINUM MEDIUM (Planch.) Trel.: FIG. 1, small fruiting plant, from Stokes Bay, Bruce Co., Ontario, *Krotkov*, no. 7570; FIG. 2, capsule, from no. 7570; FIG. 3, leaf, from no. 7570; FIG. 4, portion of leaf (opaque), illuminated by transmitted light, from no. 7570; FIG. 5, ripe carpels, from no. 7570.

LINUM MEDIUM, var. TEXANUM (Planch.) Fern.: FIG. 6, small plant, from Virginia Beach, Virginia, *Fernald & Long*, no. 3989; FIG. 7, capsule, from no. 3989; FIG. 8, leaf, from no. 3989; FIG. 9, portion of leaf, by transmitted light from no. 3989; FIG. 10, ripe carpels, from no. 3989.

L. FLORIDANUM (Planch.) Trel.: FIG. 11, leaf, from Duval Co., Florida, *Curtiss*, no. 412; FIG. 12, center of leaf, by transmitted light, from no. 412; FIG. 13, fruit, from Sumter Co., Georgia, *Harper*, no. 1026; FIG. 14, ripe carpels, from Brevard Co., Florida, *Fredholm*, no. 6157.

L. INTERCURSUM Bickn.: FIG. 15, leaf, from West Tisbury, Martha's Vineyard, Massachusetts, *F. C. Seymour*, no. 1251; FIG. 16, center of leaf, by transmitted light, from no. 1251; FIGS. 17 and 18, capsules, from Little Neck, Virginia, *Fernald & Long*, no. 3992; FIG. 19, ripe carpels, from Nantucket, Massachusetts, August 29, 1904, *Bicknell.*

PLATE 397. NYSSA SYLVATICA Marsh, var. TYPICA: FIG. 1, fruiting branch, × 1, showing characteristic leaves and long fruiting peduncles, from Dam Neck, Virginia, *Fernald & Long*, no. 4099; FIG. 2, lower surface of leaf, × 10, from no. 4099; FIG. 3, staminate inflorescence, × 3, showing the short pedicels, from Brookline, Massachusetts, *Faxon.*

PLATE 398. NYSSA SYLVATICA Marsh., var. BIFLORA (Walt.) Sarg.: FIG. 1, fruiting branch, × 1, showing the short peduncles, from Cape Henry, Virginia,

Fernald & Long, no. 4096; FIG. 2, staminate inflorescence, × 3, from Greensboro, Alabama, 1887, *S. Watson.*

PLATE 399. NYSSA SYLVATICA Marsh., var. DILATATA, n. var.: FIG. 1, portion of fruiting branch, × 1, from the TYPE, Hartwell, Hart Co., Georgia, *Wiegand & Manning*, no. 2339; FIG. 2, staminate inflorescence, × 3, from near Sebring, Highland Co., Florida, *F. W. Hunnewell*, no. 9021.

PLATE 400. NYSSA SYLVATICA Marsh., var. CAROLINIANA (Poir.) Fern.: FIG. 1, fruiting branch, × 1, from Hanging Rock, Hampshire Co., West Virginia, *F. W. Hunnewell*, no. 10,705; FIG. 2, lower surface of leaf, × 10, from no. 10,705; FIG. 3, staminate inflorescence, × 3, from Biltmore, North Carolina, *Bilt. Herb.*, no. 662^b.

PLATE 401. BACOPA MONNIERIA (L.) Wettst., var. CUNEIFOLIA (Michx.) Fern.: FIGS. 1 and 2, summits of erect plants, × 1, from False Cape, Virginia, *Fernald & Long*, no. 4185; FIG. 3, flowers, × 3, showing broad and blunt large sepals, from no. 4185; FIG. 4, flower, × 3, showing broad and blunt large sepals and corolla-lobes, from Dam Neck, Virginia, *Fernald & Long*, no. 5183; FIG. 7, terminal leaves, × 3, showing dentation, from Montgomery, Georgia *Harper*, no. 1826.

B. MONNIERIA: FIG. 5, plant, × 1, from vicinity of St. Michel de l'Atalaye, Dépt. du Nord, Haiti, *Leonard*, no. 7041; FIG. 6, fruit, × 3, showing narrow and acutish calyx-lobes, from Miragoane, Haiti, *Eyerdam*, no. 563.

PLATE 402. PHRYMA LEPTOSTACHYA L., var. CONFERTIFOLIA, n. var.: FIG. 1, plant, × 1, from Little Neck, Virginia, *Fernald & Long*, no. 4197 (TYPE).

P. LEPTOSTACHYA: FIG. 2, leaf, × 1, from Fayette, Iowa, July, 1894, *Fink.*

PLATE 403. GALIUM TINCTORIUM L.: FIG. 1, TYPE in Linnean Herbarium, × 1, from photograph supplied by Mr. S. SAVAGE; FIG. 2, flowering branch, × 1, of *G. Claytoni* Michx., from Conquest, New York, *Wiegand*, no. 7172.

GALIUM OBTUSUM Bigelow: FIG. 3, flowering branch, × 1, of *G. tinctorium* Wiegand, not L., from Conquest, New York, *Metcalf & Wiegand*, no. 7179.

PLATE 404. GALIUM TRIFLORUM Michx.: FIG. 2, characteristic small plant, × 5/12, from Brig Bay, Newfoundland, *Fernald, Long & Dunbar*, no. 27,096.

G. TRIFLORUM, var. ASPRELLIFORME, n. var.: FIG. 1, flowering plant, × 5/12, from near Great Bridge, Virginia, *Fernald & Long*, no. 4205 (TYPE).

PLATE 405. GNAPHALIUM CALVICEPS, n. sp.: FIG. 1, flowering plant, × 1, from Cape Henry, Virginia, *Fernald & Long*, no. 4245 (TYPE); FIG. 2, 1st year's rosette, × 1, from the TYPE; FIG. 3, involucres, × 5, from the TYPE; FIG. 4, tip of cauline leaf, × 10, from the TYPE.

G. FALCATUM Lam.: FIG. 5, inflorescence, × 1, from the type-region, Montevideo, Uruguay, *Herter*, no. 200, in part; FIG. 6, glomerule, × 5, from Dept. de Andalgalá, Prov. de Catamarca, Repub. Argentina, *Jorgensen*, no. 1101; FIG. 7, tip of cauline leaf, × 10, from Uruguay, *Herter*, no. 200.

G. PEDUNCULOSUM Johnston: FIG. 8, inflorescence, × 1, from Otinapa, Durango, Mexico, *Edw. Palmer*, no. 411 (TYPE); FIG. 9, tip of cauline leaf from the TYPE.

RANUNCULUS § BATRACHIUM: habit, × 1; achenes, × 10; receptacles, × 10. R. SUBRIGIDUS: FIG. 1, flowering stems; FIG. 4, achenes; FIG. 10, receptacle. R. LONGIROSTRIS: FIG. 2, flowering stems; FIG. 11, achenes; FIG. 14, receptacle. R. PUEBLENSIS: FIG. 3, stem; FIG. 7, achenes. R. LOBBII: FIG. 12, achenes. R. TRICHOPHYLLUS, var. TYPICUS: FIG. 6, receptacle; FIG. 13, achenes. Var. ERADICATUS: FIG. 5, plant. Var. CALVESCENS: FIG. 8, achenes; FIG. 9, receptacle.

CONTRIBUTIONS FROM THE GRAY HERBARIUM
OF HARVARD UNIVERSITY.

CX.

THE NORTH AMERICAN REPRESENTATIVES OF RANUNCULUS, § BATRACHIUM

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THE NORTH AMERICAN REPRESENTATIVES OF RANUNCULUS, § BATRACHIUM

W. B. Drew

(Plate 406)

The need for a revision of the North American species of the section *Batrachium* of the genus *Ranunculus* was brought to my attention by Professor M. L. Fernald. The North American Batrachian *Ranunculi* have never been intensively studied; but the European representatives of the group have received a great deal of critical attention. It is the purpose of this paper to attempt to make clear the taxonomic and phytogeographic affinities of the North American members of the section.

The first really critical study of the North American representatives of the group was that of Hiern,[1] an English botanist, who, in 1871 treated them in his worldwide survey of the group. Hiern's study is noteworthy because of his conservatism in regarding all the Batrachian *Ranunculi* as forms of a single species, *Ranunculus hydrocharis* Spenn. It is also of interest to note that in this paper Hiern described for the first time the endemic North American *Batrachium*, now known as *Ranunculus Lobbii* (Hiern) Gray. Following Hiern, Lawson,[2] a Canadian, next treated the North American *Ranunculi* in a study of importance. Lawson, though breaking away from Hiern's inclu-

[1] Hiern, W. P., On the Forms and Distribution over the World of the *Batrachium* Section of *Ranunculus*. Journ. Bot. ix. 43–49; 65–69; 97–107 (1871).

[2] Lawson, G., Revision of the Canadian *Ranunculaceae*. Trans. Roy. Soc. Canada ii. sect. iv. 44–46 (1884).

sive *Ranunculus hydrocharis,* treated *R. Lobbii* (as had Torrey and Brewer & Watson before him) as a variety of *R. hederaceus* L.; but, these two species are so well marked, as I shall later show in the synoptical section of this paper, that such a course does not now seem justified. Lawson also regarded the strictly American *R. longirostris* Godr., the arctic and subarctic *R. confervoides* Fries, and the Old World *R. Drouetii* F. Schultz as all American and as varieties of *R. aquatilis* L.

In 1886, Gray[1] revised the North American *Ranunculi;* but his study of the section *Batrachium,* though better in respect to the separation of specific entities than Lawson's treatment, reflected the then prevalent opinion that the North American representatives of *Batrachium* were identical, for the most part, with their European relatives. However, as I show in the paragraphs dealing with the geographical distribution in North America of the section *Batrachium,* the majority of our Batrachian *Ranunculi* are endemic to North America. The only other critical treatment of the North American representatives of *Batrachium* is that of Davis,[2] who made a taxonomical study of the North American *Ranunculaceae* in 1900. In his study, Davis, largely following the earlier (1897) arrangement of Britton and Brown,[3] added little to a clearer understanding of *Batrachium* in North America.

Diagnostic Characters

Gynoecium. In distinguishing between the species of the *Batrachium* section of *Ranunculus,* the mature fruits offer perhaps the most valuable diagnostic characters. The shape of the achenes does not seem to be reliable, except between species which are otherwise not closely related. Length of achenes, providing many measurements of the fruit of a given species are made, is of diagnostic value. Thus, for example, the achenes of *Ranunculus longirostris* range from 1–1.6 mm. in length, whereas those of the closely related *R. subrigidus* are from 1–1.5 mm. long; but the average length of the achene in *R. longirostris* is 1.5 mm., in *R. subrigidus* 1.25 mm. Moreover, *R. Lobbii* may be set off from most of the other Batrachian *Ranunculi* because of its relatively large (2.25 mm. long) achenes. The number

[1] Gray, A., *Revision of the North American Ranunculi.* Proc. Am. Acad. Arts & Sci. xxi. 363–378. (1886).

[2] Davis, K. C., *Native and Cultivated Ranunculi of North America and Segregated Genera.* Minn. Bot. Studies ii. 460–462. (1900).

[3] Ill. Fl. No. U. S. and Can. ii 83–84. (1897).

of achenes per flower is also significant, although in certain instances, as in *Ranunculus trichophyllus* and its varieties, the value of this character is somewhat lessened by the frequent failure of carpels to reach maturity. In general, however, number of achenes is useful if treated with due regard to the variation in each species. The length and position of the persistent style-base, or beak, are important. The achenes of *Ranunculus longirostris,* for example, may be distinguished from those of all other Batrachian *Ranunculi* by their long beaks (± 1 mm.). The lateral position of the persistent style-base of the achene is significant in *R. Lobbii,* since in the other North American species it is usually subterminal or rarely sublateral.

The pubescence of the fruit, which has been widely employed in distinguishing between species of *Batrachium,* is composed of stout trichomes which are usually localized on the upper or convex side of the achenes. Often, however, the presence of these hairs is affected by the abrading action of running water. Nevertheless, at least one *Batrachium* in North America, *Ranunculus trichophyllus,* var. *calvescens,* appears to have carpels with deciduous trichomes, for the latter, though sparingly present on the immature fruit, are consistently absent at maturity. Among the other Batrachian *Ranunculi,* only *R. hederaceus* and *R. Lobbii* have the achenes glabrous from the first.

The receptacle of the fruit is of some diagnostic value. Thus, in *Ranunculus subrigidus,* the length of the receptacle is usually between 1.75 and 2 mm., whereas in the closely related *R. longirostris,* the receptacle is about 1.25 mm. long. In *R. Lobbii* the receptacle is very short (0.75 mm.) and usually glabrous. The eastern variety of *Ranunculus trichophyllus* (var. *calvescens*) is distinguished from the typical form of the species by its essentially glabrous receptacle. In general, except for *R. Lobbii, R. hederaceus* and *R. trichophyllus,* var. *calvescens,* the receptacle of the North American Batrachian *Ranunculi* is pubescent.

Androecium. Although the shape of the anthers and the relative length of stamens and carpels have often been employed as diagnostic characters, it is probable that the state of maturity of the flower effects such divergences.[1] Thus, these supposed stamineal characters are not of much taxonomic importance. The number of stamens is of some taxonomic significance, though in common with many other characters of the group, it is variable within limits for a given species.

[1] See Freyn, J., *Zur Kenntnis einiger Arten der Gattung Ranunculus* ii., Beil. Bot. Centralbl vi. nr. 26: 11 (1881).

PERIANTH. The size of the petals of the Batrachian *Ranunculi* is of limited value for classificatory purposes since those of each species, though variable, are of the same general length-range. In two species, *Ranunculus hederaceus* and *R. Lobbii*, the petals are consistently very small (5 mm. in length). In *R. trichophyllus*, however, the size of the petals is much more variable. Finally, in *R. subrigidus*, the veins of the petals are important since they are less forked toward the distal extremity than they are in those of the closely related European *R. circinatus*. The nectarial scales at the base of the petals are, according to Freyn (l. c.), consistently round; but my studies show that the nectaries vary considerably in their development within a given species. Indeed the simple round type is scarcely present in most petals of our North American species. The white color of the petals of the section *Batrachium* is one of the constant characters of the group; but white petals are not confined to the *Batrachium* section, since several species in other sections of the genus also have them. The sepals, while exhibiting several variations in their gross morphology, do not have differences of taxonomic importance.

FOLIAGE. In general the foliage consists of two primary kinds, the dissected, immersed type and the dilated, floating type. In those species which are heterophyllous, all kinds of foliage transitional from one type to the other may be growing even on the same plant. The foliage of the homophyllous species is also very variable. With such foliar variation possible, then, considerable taxonomic discrimination must be exercised in the selection of truly diagnostic foliar characters. The North American plants which are heterophyllous show many variations in their foliage; but, because of the lack of fundamental differences in reproductive structures and since they share a common geographical distribution (western United States and Canada to Alaska), I have concluded that they are better treated as one specific type. Moreover, these heterophyllous North American representatives of *Batrachium* do not offer fundamental distinctions from the more widespread and homophyllous (with dissected, immersed foliage) *R. trichophyllus*. Accordingly, I am treating the American heterophyllous plants as var. *hispidulus* (E. R. Drew) of *R. trichophyllus*. Whether our western plant with heterophyllous foliage is conspecific with the European *R. heterophyllus* Web. is not clear, for the latter appears to be separable in Europe from the types there with dissected immersed leaves.

Among the other dissected-leaved North American species are

Ranunculus longirostris Godr. and my *R. subrigidus*, both of which are characterized by a more or less circinate circumscription of the leaves. In *R. longirostris* the leaves are mostly all sessile at the apex of the stipular sheaths, whereas in *R. subrigidus*, usually the lower and occasionally all the leaves are shortly but definitely petiolate. The leaves of *R. subrigidus*, which has long passed in North America as the European *R. circinatus*, differ from the foliage of the latter in being of a much less rigid texture, and the segments are usually longer.

All the Batrachian *Ranunculi* have stipular sheaths, though variously developed, at the base of the petioles of their leaves. Considerable variation is shown in the morphology of these sheaths, but as specific characters I have not found them of much importance.

Miscellaneous. The presence of adventitious roots, while admittedly a response to severe environmental conditions, appears to characterize the northern plant often passing as *Ranunculus confervoides* Fries. Only rarely do the Batrachia of more temperate regions develop adventitious roots extensively. Similarly, *R. confervoides*, which I am here reducing to a geographic variety, var. *eradicatus* (Laest.), of *R. trichophyllus*, is further characterized by a filiform or very slender stem; but it is doubtful if this character is of much significance.

Geographical Distribution

The section *Batrachium* has a wide geographical distribution. The various species occur chiefly in the temperate regions; *R. trichophyllus*, var. *eradicatus*, however, is found in Greenland as far north as 76° 30′.[1] Another species, *R. pueblensis*, is localized south of the Tropic of Cancer in the highlands of southern Mexico; but, in this case, the altitude (2,000 m.) partially offsets the apparent tropical distribution.

Turning to a consideration of the distribution of the various species in North America, we find significant ranges which, in most cases, can be correlated with those already worked out for many other plants, terrestrial as well as aquatic. One species, *Ranunculus longirostris*, in the East at least, shows a preference for calcareous waters, and it is probable that it and *R. subrigidus* have a similar preference westward. *R. hederaceus* has been reported by Morris[2] in waters which were probably calcareous. As to the soil preferences of the other

[1] From plants (now in the Gray Herbarium) collected at North Bay, 76° 30′ N. Lat., NW. Greenland, by W. E. Ekblaw of the Crocker Land Expedition.

[2] According to Morris, E. L., Proc. Biol. Soc. Wash. xiii. 157–158 (1900). *R. hederaceus* was growing in shallow waters over marly soil.

species, however, I have little accurate field data on which to base general conclusions.

Taking up the distribution of each species in North America, it is found that several types of segregation from and identities with Old World floras are manifest. These various types of distribution may be grouped as follows: first, species confined in North America to the East, but growing also in western Europe; second, species confined to western North America, chiefly endemic; third, species of a fairly general range in North America, also endemic; fourth, species of eastern and western North America and western Europe (and probably eastern Asia as well); and, fifth, plants of more general circumpolar distribution in the northern hemisphere.

Ranunculus hederaceus comprises the first group which, in North America, is confined to the East, but which also occurs in western Europe. In North America, *R. hederaceus* occurs at several stations in Newfoundland, in Bucks County, eastern Pennsylvania, and at certain stations around or near the Chesapeake Bay region of Maryland and Virginia. It has also been reported by Elliott[1] from Charleston, South Carolina, where Bosc discovered the plant about 1821. From the fact that Elliott reported the plant as rare or extinct and because more recent studies of the flora of the southeastern United States do not include *R. hederaceus*, there is a question whether it still exists in South Carolina. Evidently Bosc believed the plant to be naturalized from Europe, for Elliott wrote that it was "apparently naturalized." Gray, in 1871, stated that *R. hederaceus* had all the appearance of being indigenous near Norfolk, Virginia. Morris,[2] however, who discovered a station for *R. hederaceus* at the head of navigation on the Patuxent River, Maryland, presumably regarded the species as introduced from Europe, for he speaks of "The first record by name of station of the introduction of this species from Europe." Thus it may be that *R. hederaceus* is introduced there, but should field studies indicate that the plant is as quiescent or nonaggressive in the Chesapeake Bay region as it is in southeastern Newfoundland, one would have reason to consider it probably indigenous.

From a theoretical standpoint, at least, it is entirely possible that *Ranunculus hederaceus* is indigenous about the Chesapeake Bay region. Its discontinuous distribution in eastern North America, with a gap between eastern Pennsylvania and Newfoundland, is

[1] Sketch Bot. So. Carol. & Ga. ii. 56 (1821).
[2] Proc. Biol. Soc. Wash. loc. cit.

shared by many other plants, as Fernald[1] has repeatedly pointed out. In his latest study, *Recent Discoveries in the Newfoundland Flora*, Fernald concludes that the plants of austral affinities, such as *Schizaea pusilla* Pursh, the *Xyridaceae* and their associates, which also have a discontinuous range in eastern North America, either lived in Newfoundland throughout the Pleistocene or reached Newfoundland in Pre-Wisconsin time either from the North or the South. It was possible for the plants to migrate to Newfoundland from the North because of the existence of the uplifted floor of the North Atlantic basin which connected North America with Europe. Moreover, it was equally possible for these plants to migrate from the South where, presumably, they had been established long before the Pleistocene, along the now submerged continental shelf which forms the Banks of the present time. This latter idea gains force from the results of the investigations on the New England-Acadian Shoreline by Douglas Johnson[2] who finds that the continental shelf and banks cuesta were submerged in "at least post-Miocene, and more probably post-Pliocene." Thus the plants already established in the South would have had little difficulty migrating North along the upraised continental shelf; but the point I wish to emphasize is that it was entirely possible for *R. hederaceus* to migrate southward from Newfoundland along the old continental shelf to the Chesapeake Bay region (and probably to South Carolina) where it now persists in scattered favorable localities.

Returning to a consideration of the situation of *Ranunculus hederaceus* in Newfoundland, it seems pretty clear that the plant is indigenous there, since Fernald[3] has found it to occur in natural and undisturbed habitats, and to share its Old World affinities with many plants. Plants of this group probably made their way across the land which is now the floor of the North Atlantic (or at least were continuously distributed from northern Europe across this land bridge to eastern North America) from northern Europe to eastern North America during the long interglacial epoch prior to the Wisconsin glaciation, and have persisted, especially in southeastern Newfoundland where

[1] A Botanical Exp. to Newfoundland and So. Lab., RHODORA xiii. 135–162 (1911); Some Relationships of the Floras of the No. Hemisph., Proc. Int. Cong. Pl. Sci., Ithaca (1926) ii. 1494–1500 (1929); Specific Segregations and Identities in Some Floras of E. No. Am. and the Old World, RHODORA xxxiii. 25–63 (1931); Recent Discoveries in the Newfoundland Flora, RHODORA xxxv. 97–107 (1933).

[2] *The New England-Acadian Shoreline*, 301–304 (1925). N. Y., John Wiley & Sons; London, Chapman & Hall.

[3] Proc. Int. Cong. Pl. Sci. Ithaca (1926) ii 1506 (1929).

the Wisconsin ice was very local, as relic species. Thus, *Ranunculus hederaceus*, probably migrating to North America in early or mid-Pleistocene, was widespread on the now submerged continental shelf to Chesapeake Bay, and with its submergence (post-Miocene or post-Pliocene, but pre-Wisconsin) and the ensuing Wisconsin glaciation became isolated in Newfoundland, the Chesapeake Bay region, and South Carolina.

The origin in North America of the second group of species, those endemic to western North America, is not as clearly correlated with geological history as is that of *Ranunculus hederaceus* of the Atlantic coast. *R. Lobbii* of the coast ranges of California, western Oregon, and Vancouver Island, is, however, the most sharply defined species of any North American member of the *Batrachia*, since in its odd, trilobed, dilated leaves, the very small flowers, and the very few (3–6) achenes which are extremely large and possess a lateral mucro, unlike the fruit of any other *Batrachium*, the plant is unique. Its closest relative is the European *R. tripartitus* DC.; but the latter never has the few large achenes with lateral persistent style-bases and the more or less persistent calyces of *R. Lobbii*.

Gray[1,2] first pointed out the antiquity and relationships of much of the Californian flora, but Jepson[3] and Abrams,[4] with more data at their command, have pointed out the high degree of endemism which characterizes the California plants. Fernald,[5] again, emphasized that there is a considerable group of plants in the northern hemisphere which occur in Europe and Pacific America, but which are absent from eastern Asia and eastern America. The explanation and origin of this type of distribution is not clear; Fernald points out that, although the climate of Pacific America and Atlantic Eurasia are similar, it is difficult to believe that climate alone could have brought about such a segregation. *Ranunculus Lobbii*, then, is a plant endemic to western North America (chiefly California), and like much of the Californian flora is old. Its origin is not clear, except that it is probable that it and its closest relative, *R. tripartitus*, of Europe have evolved from a common progenitor.

Restricted to the Far West, also, is the heterophyllous and endemic extreme of *Ranunculus trichophyllus* which I am treating as *R. tricho-*

[1] Mem. Am. Acad Arts & Sci. vi. 377–452 (1859).
[2] Proc. Am. Ass. Ad. Sci. xxi. 1–31 (1872).
[3] Man. Fl. Pl. Calif. 10–14 (1925).
[4] Proc. Int. Cong. Pl. Sci. Ithaca (1926) ii. 1520–1524 (1929).
[5] Proc. Int. Cong. Pl. Sci. Ithaca (1926) ii. 1489–1491 (1929).

phyllus, var. *hispidulus*. This plant ranges up the coast to Alaska and occurs as far East as western Montana and Utah. Unlike *R. Lobbii*, whose characters are sharply defined, *R. trichophyllus*, var. *hispidulus* has been a very baffling plant to interpret taxonomically, for certain of its forms appear to be referable to groups which, in Europe, have been treated as distinct species. The American plants seem to be inseparable one from the other, whereas in the Old World species bearing heteromorphic leaves such divergences of several species appear to be distinct. On that account and because I cannot specifically separate our western plant with dilated leaves from *R. trichophyllus*, as the latter occurs in North America, I am treating it as a variety of that species. More extensive studies may show that our western plant with dilated leaves includes one or more Old World types, but, for the present, I believe it is best treated as endemic to our continent. As in the case of *R. Lobbii*, its origin in western North America is not clear. It is probable, however, that *R. trichophyllus*, var. *hispidulus* and its European representatives evolved from a common progenitor, because the plants from both continents are taxonomically closely related.

The third group of species, which are also endemic, are those which are fairly widespread over the chiefly calcareous regions of North America. The most clear-cut of these plants is *Ranunculus longirostris*. This species attains its greatest development in the limy waters of the Great Lakes region, occurring only occasionally in the Southwest. This type of distribution is shown by many plants preferring calcareous soils, as, for example, *Potamogeton strictifolius* Ar. Benn.[1] *Ranunculus subrigidus* also seems to favor waters which are basic; but, curiously enough, it is mostly absent from the calcareous lakes and ponds of the Great Lakes region where *R. longirostris* reaches its greatest development. *R. subrigidus* is more characteristic of the West and Southwest and is much more widely dispersed than *R. longirostris*. Whether *R. subrigidus* is confined to limy waters I am not positive, since my data are incomplete on this subject. At any rate, *R. subrigidus* is very closely related, taxonomically, to the European *R. circinatus*. Presumably, then, *R. subrigidus* and *R. circinatus* had as a common ancestor a plant which was distributed continuously from Europe to North America in Cretaceous or Tertiary time.

The species of the fourth group occur in both eastern and western

[1] *The Linear-Leaved North American Species of Potamogeton*, Mem. Am. Acad. xvii. pt. 1: 55–60 (1932).

North America, as well as in western Europe and probably eastern Asia. *Ranunculus trichophyllus* has a discontinuous range; with rare exceptions, it is absent from most of the Mid-West. In the eastern part of our continent it grows in either basic, neutral or acidic waters, but I have had no personal acquaintance with its habitats in the West. It has a range which, as Fernald[1] has shown, is shared by many other plants, terrestrial as well as aquatic. He has pointed out that such plants as *Potamogeton pusillus*, *P. epihydrus*, *Brasenia Schreberi* and others he cites, are chiefly excluded from the Great Plains by alkalinity of the waters. He presupposes a continuous distribution across the continent in median latitudes during Tertiary time and long after the withdrawal of the Cretaceous seas for these aquatic and the many terrestrial plants which share their ranges. Then, with the advent of the Pliocene uplift of the Cordilleran region, which brought about an increase of aridity east of the Pacific slope, the waters naturally became more alkaline, so that the Potamogetons mentioned above, as well as other plants of less alkaline to acid waters, were excluded. With little accurate field data on the soil preferences of *R. trichophyllus*, it is difficult, not to say unwise, to attempt generalizations concerning its distribution; it may be that further studies will indicate that it should be included with those plants just discussed, the distribution of which appears to depend upon proper edaphic conditions.

Finally, another type of distribution is illustrated by the nearly circumpolar *Ranunculus trichophyllus*, var. *eradicatus*. As far as my studies have shown, this arctic and sub-arctic plant is nothing but the extreme northern form of *R. trichophyllus*. Its present distribution in North America is wide, the plant occurring in Labrador, Newfoundland, parts of the Gaspé Peninsula, the James Bay region, northern Wyoming and Alaska. It is fairly common in Greenland, at least on the west coast where it gets as far north as 76° 30′; it is found also in Iceland, northern England, Scandinavia, rarely in the high mountains of France and Italy, and in eastern Eurasia. Such wide arctic and sub-arctic dispersal is characteristic of many plants. It seems to me that *R. trichophyllus*, var. *eradicatus* represents a northern variation of *R. trichophyllus* which gradually evolved from the widespread typical form as the Pleistocene glaciations brought about an increasingly colder climate in the northern areas. This is supported by the fact that it does not differ fundamentally from typi-

[1] *The Linear-Leaved North American Species of Potamogeton*, Mem. Am. Acad. xvii, pt. 1: 27–28 (1932).

cal *R. trichophyllus*, and also because it appears to occur further south in Europe, at least, in alpine regions where the climatic conditions are of near-arctic severity.

Synoptic Treatment of the North American Species

My thanks are especially due to the United States National Museum and the University of California for loan of their collections. I also wish to extend my thanks to Dr. Cotton of the Royal Botanical Gardens at Kew, England, for placing their collection at my disposal. Dr. Pennell of the Academy of Natural Sciences at Philadelphia and Dr. Merrill of the New York Botanical Garden have most kindly lent me the plants which comprise the original collection of *Ranunculus Porteri* Britton. In this paper, the material from the Gray Herbarium and from the Herbarium of the New England Botanical Club has not been specially indicated. Other collections are indicated as follows: Boston University (B. U.), United States National Herbarium (U. S.) and University of California (Cal.).

In this paper I am regarding *Batrachium* as a section of *Ranunculus* and not as a separate genus, because the definitive characters of *Batrachium*, in the final analysis, are not restricted to it. Whether *Batrachium* should be considered a section or a sub-section under *Ranunculus* is a question I am in no position to answer, because I am not familiar enough with the other plants of the genus. Prantl[1] has arranged the species of *Ranunculus* according to a system which is based on a wide knowledge of the group, and upon evidence derived from morphological as well as taxonomical investigations. According to this well-established system, *Batrachium* is a sub-section under the section *Marsypadenium*.

Key to the Indigenous North American Species and Varieties of Ranunculus § Batrachium

a. Plants with dilated floating leaves only, shallowly 3–5-lobed, subtruncate at the base with wide sinuses: achenes glabrous: receptable glabrous . . . . 1. *R. hederaceus.*

a. Plants with dilated floating leaves and dissected immersed leaves, or only the latter; dilated leaves variously, but not shallowly 3–7-lobed: achenes hairy or glabrous: receptacle hairy (except in *R. Lobbii* and *R. trichophyllus*, var. *calvescens*) . . . . *b.*

b. Blades of dissected immersed leaves all usually petioled above the stipular sheaths, collapsing when withdrawn from water; stipular sheaths narrow except on the immature leaves, mostly adnate to the petioles . . . . *c.*

[1] Prantl, K., Beit. Morph. Syst. Ranunc., Bot. Jahrb. ix. 263–268 (1888).

c. Dissected immersed leaves rudimentary and few, usually near the base of the plant: carpels usually 2–6 (av. 3); persistent style-base chiefly lateral to sublateral, inconspicuous . . . . 2. *R. Lobbii.*

c. Dissected immersed leaves various, usually well developed: carpels 8–40; persistent style-base terminal to sublateral, never lateral, mostly conspicuous. . . . *d.*

d. Dilated floating leaves developed; plants of western North America . . . . 3. *R. trichophyllus,* var. *hispidulus.*

d. Dilated floating leaves undeveloped. . . . *e.*

e. Stems rarely filiform, not usually rooting at many of the nodes; segments of dissected leaves rarely filiform: stamens mostly 10–15: achenes usually very rugose. . . . *f.*

f. Receptacle mostly long-hairy: achenes 1.25–1.5 mm. long, frequently hairy at maturity . . . . 4. *R. trichophyllus,* var. *typicus.*

f. Receptacle essentially glabrous: achenes 1.5–1.75 mm. long, glabrous at maturity: plants of easttern North America . . . . 5. *R. trichophyllus,* var. *calvescens.*

e. Stems filiform, rooting extensively at the nodes: segments of the dissected leaves filiform: stamens usually 5–10: achenes often smooth: plants arctic, subarctic and arctic-alpine. . 6. *R. trichophullus,* var. *eradicatus.*

b. Blades of dissected leaves sessile above the stipular sheath to rarely petiolate, often remaining firm on withdrawal from water; stipular sheaths mostly broad and well developed on the majority of the leaves, rarely completely adnate to the petioles. . . . *g.*

g. Achenes not over 1.6 mm. long, exclusive of the persistent style-base, rather finely rugose; beak not stout and recurved: first divisions of the leaves not long-stalked. . . . *h.*

h. Persistent style-base forming a short beak (0.2–0.5 mm.) at maturity; achenes very many (30–80), but usually about 40, averaging 1.25 mm. in length: stipular sheaths pubescent or not, usually ¾ to completely adnate to the petioles . . . . 7. *R. subrigidus.*

h. Persistent style-base forming a long beak (± 1 mm.); achenes several to many (8–30), but usually about 16, averaging 1.5 mm. in length: stipular sheaths very hairy, usually ¼–¾ adnate to the petioles. . . . . 8. *R. longirostris.*

g. Achenes 2–2.75 mm. long, exclusive of the persistent style-base, rather coarsely rugose; beak rather stout and more or less recurved: first divisions of the leaves very long (0.6–1 cm.)-stalked . . . . 9. *R. pueblensis.*

1. Ranunculus hederaceus L. Stems creeping, with adventitious roots at many of the nodes: dilated leaves only present; blades more or less reniform, shallowly lobed into 3–5 segments; petioles with rather membranaceous, ½–⅔ adnate stipular sheaths: flowers 4–7 (usually 5–6) mm. in diameter: petals 3–5-veined: stamens 6–10: carpels 10–16 (av. 12), mostly glabrous; mature achenes 1–1.5 (av. 1.25) mm. long, sharply keeled all around, absolutely glabrous and prominently rugose; persistent style-base small, subterminal to sublateral: receptacle 1–1.5 (av. 1.25) mm. long, entirely glabrous.— Sp. Pl. 556 (1753); Oeder, Fl. Dan. ii. fasc. vi. 3, t. 321 (1766); Biria,

Hist. Renonc. 33 (1811); Reichenb. Ic. Fl. Germ. iii. t. 2 (1838–39); Gren. & Godr. Fl. Fr. i. 19 (1847); Bab. Man. Brit. Bot. ed. 4: 8 (1856); Gray, Syn. Fl. No. Am. i. 22 (1895); Rob. & Fern. in Gray, Man. ed. 7: 394 (1908); Hegi, Ill. Fl. Mitt.-Eur. iii. 577, t. 118, f. 7 (1912); Pearsall, Bot. Soc. & Exch. Club Brit. Isl. Rep. viii. 837 (1928). *R. Hederaefolius* Salisb. Prod. Stirp. 373 (1796). *Batrachium hederaceum* (L.) S. F. Gray, Nat. Arr. Brit. Pl. ii. 721 (1821). *R. hydrocharis*, β. *Homoiophyllus*, α. *Hederaceus* Spenn. Fl. Frib. iii. 1008 (1829). *B. omiophyllus* Tenore, Fl. Neapol. iv. 338 (1830).[1] *R. hydrocharis*, forma *hederaefolius* (Salisb.) Hiern, Journ. Bot. ix. 67 (1871). *R. hederaceus* L., var. *hederaefolius* (Salisb.) Lawson, Trans. Roy. Soc. Canada, ii. sect. iv: 44–45 (1884), excluding synonym *R. aquatilis*, var. *arcticus* Durand.—In shallow water and wet shores, Newfoundland; Chester Co., Pennsylvania; Maryland; southeastern Virginia; South Carolina; western Europe. The following are typical: NEWFOUNDLAND: Open Hall Cove, Bonavista Bay, Aug. 16, 1879, *H. L. Osborn* (U. S.), distributed as *R. hyperboreus* Rottb.; shores of Quiddy Viddy Lake, *Robinson* & *Schrenk*, no. 31; between Quiddy Viddy and Middle Cove, *Fernald* & *Wiegand*, no. 5423; Murray's Pond, July, 1931, *Agnes M. Ayre;* Bishop Field Grounds, St. John's, July, 1931, *Agnes M. Ayre;* New Harbour, 1890, *Waghorne;* by spring in gravel beach, Carbonear, *Fernald* & *Wiegand*, no. 5424. PENNSYLVANIA: growing in shallow water along road near Lee's Bridge, Chester Co., *Hans Wilkens*, no. 161. MARYLAND: Mt. Calvert, Prince George Co., *Shreve*, no. 1556 (U.S.); swamp south of the confluence of its western branch with the Patuxent River, Prince George Co., *E. L. Morris*, no. 919 (U.S.); along the Patuxent River for four miles below its western branch, Prince George Co., *E. L. Morris* no. 1407 (U.S.). VIRGINIA: shaded spring bog, Hampton, May 18, 1903, *G. S. Miller, Jr.* (U.S.); south of Virginia Beach, Princess Anne Co., May 26, 1893, *Britton* & *Small* (U.S.); Hampton, 1878, *Vasey* (U.S.); Norfolk, *L. F. Ward*, no. 826 (U.S.); Dismal Swamp, 1877, *Chickering* (U.S.); Chesapeake City, May 12, 1877, *L. F. Ward* (U.S.); Hampton, May 14, 1877, *Morong* (U.S.); wet sand bordering swampy woods and thickets back of the dunes, along Back Bay, south of False Cape, Princess Anne Co., *Fernald* & *Long*, no. 3937.

This species is worth more than passing mention in this study because of the interest attached to its various discoveries in North America, and for its significant geographical distribution which I have discussed in the preceding pages. The first collection of the species in North America was made about 1821 at Charleston, South Carolina, where Bosc discovered the plant, according to Elliott.[2] His note seems to have escaped the attention of later botanists and, apparently, the plant has not subsequently been reported in South Carolina.

[1] According to Pearsall, l. c.
[2] Sketch Bot. So. Carol. & Ga. ii. 56 (1821).

Thus, Gray[1] wrote, erroneously, as it now appears, that *R. hederaceus* was first collected on this continent near Norfolk, Virginia, where J. M. M. Muir found it in 1870. In the next few years following 1870, *R. hederaceus* was discovered at "Chesapeake City," near Hampton, Virginia, by Dr. L. F. Ward in 1877 and, during the same year, in Dismal Swamp, Virginia, where it was found by Chickering. The next new locality in Virginia was at Virginia Beach, Princess Anne Co., where Britton and Small collected it in 1893. Meanwhile, however, a significant range-extension was made by Dr. H. L. Osborn in 1879, when he collected the plant in Open Hall Cove, Bonavista Bay, Newfoundland. Through the kindness of the United States National Herbarium, I have been able to examine Osborn's plant which is unquestionably *R. hederaceus*. Presumably Gray, at the time (1886) of his Revision of the North American Ranunculi (l. c.) was unfamiliar with Osborn's plant, for he wrote under the discussion of *R. hederaceus*, that although it was said to be apparently indigenous at many stations near Norfolk, Virginia,[2] the fact that it occurred nowhere else indicated that it was an introduction from Europe. However, in the treatment in the Synoptical Flora of North America i. 22 (1895), Gray's earlier opinion (1886), that *R. hederaceus* was a European introduction, was maintained by the editor even though, at that time, it had been collected by Waghorne in 1889 and 1890 near New Harbour, Bonavista Bay, Newfoundland;[3] by Miss Southcott at St. John's, Newfoundland, in 1893;[4] and by Robinson & Schrenk on the shores of Quiddy Viddy Lake, Newfoundland, in 1894.[5]

Since the publication of the Synoptical Flora, many new stations for the plant have been discovered. Morris, in 1900,[6] found the species in a swamp near the head of navigation on the Patuxent River, Prince George Co., Maryland. Numerous other collections

[1] Gray wrote, in the note describing the discovery for the "first time" in North America of *Ranunculus hederaceus*, that it was collected by the late Dr. Munn (Am. Journ. Sci. & Arts ser. 3, ii. 476 (1871). Subsequently, in his *Revision of the North American Ranunculi* (Proc. Am. Ac. Arts & Sci. xxi. 364 (1886). Gray stated that it was first collected by Muir in 1870. The original collection, now in the Gray Herbarium, bears the name of J. M. M. Muir as collector. Probably, then, Muir was actually the collector, and not Munn.

[2] As a matter of fact, Gray wrote earlier (1871, l. c.) that *R. hederaceus*, when "first" discovered in North America near Norfolk, Virginia, had all the appearance of being indigenous.

[3] Bot. Gaz. xvi. 285 (1891).

[4] Trans. Nov. Scot. Inst. Sci. ser. 2: i. 363 (1893).

[5] Notes on Fl. Newf'd., Can. Rec. Sci. vii. 7 (1896).

[6] Proc. Biol. Soc. Wash. xiii. 157 (1901).

from Carbonear on the shores of Conception Bay and the general vicinity of St. John's, Newfoundland, have added to the known stations for this plant in Newfoundland. More recently (1929), Wilkens discovered a station much further inland at Lee's Bridge, Chester Co., Pennsylvania,[1] and in 1934 Fernald & Long found it with strictly indigenous species on wet sands of Back Bay, near the North Carolina border, south of False Cape, Virginia.

It is evident, then, that *R. hederaceus* was much more widespread than Gray knew when he first revised the North American *Ranunculaceae* (l. c.). Robinson & Schrenk, in "Notes on the Flora of Newfoundland," (l. c.) came to the conclusion that the evidence at that time (1896) was not clear as to whether *R. hederaceus* was indigenous, especially since their stations were near a prominent port. Later and more thorough botanical explorations in Newfoundland, however, indicate that *R. hederaceus* occurs at many stations on the Avalon Peninsula. Thus, Fernald[2] has pointed out in "Some Relationships of the Floras of the Northern Hemisphere" that *R. hederaceus* is apparently indigenous in Newfoundland, especially since it shares natural and undisturbed habitats with or near many other European types, such as *Potamogeton polygonifolius* Pourret, *Glyceria fluitans* R. Br., *Sieglingia decumbens* Bernh., *Nardus stricta* L., *Calluna vulgaris* (L.) Hull, and *Pedicularis sylvatica* L.

Although Hiern (l. c.) stated that *Ranunculus hederaceus* reaches the Rocky Mountains, where it has "larger flowers and more numerous stamens than in the type," neither extant specimens nor records of the plant in recent floristic studies of the region are known. Indeed the material in the Gray Herbarium, the United States National Herbarium, the Herbarium of the University of California, and the Kew Herbarium includes no authentic specimens of *R. hederaceus* from the Rocky Mountain region or, for that matter, the West as a whole. It seems probable, then, that Hiern was dealing with some other species.

Lawson (l. c.) interpreted Durand's[3] *Ranunculus aquatilis*, var. *arcticus*, from "Disco and adjacent coast, 70°," as *R. hederaceus;* but

[1] *Pennsylvania:* growing in shallow water, along road near Lee's Bridge, Chester Co., *Hans Wilkens*, no. 161. (Distributed by the Philadelphia Academy of Sciences).

[2] Proc. Int. Cong. Pl. Sci. Ithaca (1926) ii. 1506 (1929).

[3] Durand, in the Plantae Kaneanae Groenl., Journ. Acad. Nat. Sci. Philadel. iii. 185 (1856), published a new *Ranunculus, R. aquatilis* L., var. *arcticus* from "Disco and adjacent coast, 70°." Durand stated that his plant has a great affinity with DeCandolle's "*R. aquatilis*, var. *hederaceus*, *R. hederaceus*, Lam., not of Linn." No plate accompanies the description, and I have seen no specimen, so that I must rely on Porsild's statement as to the nature of Durand's plant.

Porsild[1] has not found *R. hederaceus* either on Disko Island or the adjacent coast, although it is certain that he would have done so if it actually grew there. He has no doubt whatever that the plant which Durand collected was *R. hyperboreus* Rottb., in which the "flowers often become white during drying, especially when the specimens are laid in the press in wet condition." Thus it seems very probable that *R. hederaceus* L. is confined in North America to Newfoundland and to scattered stations from Pennsylvania to southeastern Virginia.

2. R. Lobbii (Hiern) Gray. Plants with heteromorphic leaves, both dilated and dissected; leaves all petioled with well developed stipular bases one-half to completely adnate; dilated leaves deeply tripartite, with the lobes nearly at right angles to each other, and secondarily, shallowly, though sharply notched; dissected leaves few, usually rudimentary and confined to the lower nodes: flowers 0.6–1.5 cm. in diameter: veins of the petal 4–6 (av. 5): stamens 12–16 (av. 12) in number: carpels 2–5 (av. 3) per fruiting head, absolutely glabrous; mature achenes 2–2.6 (av. 2.25) mm. long, glabrous, more or less inflated, oblong-ovate, with rugosities more or less continuous and sharply delineated from the surface; persistent style-base short and definitely lateral: receptacle 0.5–1 (av. 0.75) mm. long, conical, thick, not at all narrowed at the base and entirely glabrous.—Proc. Am. Acad. xxi. 364 (1886) and Synop. Fl. i. pt. 1: 22 (1895); Jepson, Man. Fl. Pl. Calif. 391 (1925). *R. hederaceus* L., var., Torrey, Rep. Whipple Exp. 102 (1857); *R. hydrocharis* Spenn., forma *Lobbii* Hiern, Journ. Bot. ix. 66, t. 114 (1871). *R. aquatilis* L., var. *Lobbii* (Hiern) Watson, Bibl. Ind. 17 (1878). *R. hederaceus* L., var. *Lobbii* (Hiern) Brewer & Wats. Bot. Cal. i. 5 (1876); Lawson, Trans. Roy. Soc. Can. ii. sect. iv: 44 (1884). *Batrachium Lobbii* (Hiern) Howell, Fl. Nw. Am. i. 13 (1897).—Vancouver Island, western Oregon, and western California, where it grows chiefly in pools and quiet waters. The following are representative: California: Mt. Tamalpais, Marin Co., *Eastwood*, no. 3163 (U.S.); St. Helena, Napa Co., *C. F. Baker*, no. 1997 (U.S.); Black Mountain, Santa Clara, *Elmer*, no. 4734 (U.S.); Sonoma Valley, *Jepson*, no. 5083 (U.S.); Windsor, Sonoma Co., *Sidney S. Holman*, 1884 (U.S.); near Windsor, Sonoma Co., *Heller & Brown*, no. 5060 (U.S.); 35th parallel of Latitude, 1853–4, *J. M. Bigelow* (U.S.); pond on hill, 2 miles south of San Pablo, Apr. 17, 1888, *Greene* (U.S.); Vacaville, 1892, *Jepson* (U.S.); Byron Springs, March 25, 1888, *Greene* (U.S.); in shallow stagnant water, on Tomalis Bay, Apr. 1886, *Greene;* Mt. Tamalpais, Marin Co., April, 1899, *Eastwood;* North Berkeley Hills, San Francisco Bay Region, *Chandler*, no. 787; Fairfax, Marin Co., Apr. 14, 1895, *Eastwood;* pond in Bolinas, Marin Co., Apr. 15, 1891, *Chestnut & Drew* (Cal.); Valley Ford, Sonoma Co., 1906, *Emma Sobenstein* (Cal.); Glen Ellen, Sonoma Co., *M. S. Baker*, no. 603 (Cal.); pool near Olema, Marin Co., Apr. 27, 1931, *L. S. Rose*

[1] Meddel. om Grönl. lviii. 79 (1926).

(Cal.); Alfine School House, San Mateo Co., *Elmer*, no. 4734 (Cal.); ponds in Upper Napa Valley, near Calistoga, May 1, 1893, *Jepson* (Cal.); Glenwood, Santa Cruz Co., May 1893, *Michener* & *Bioletti* (Cal.); Healdsburg, Apr. 1897, *Alice King* (Cal.); Cajadero, Sonoma Co., *J. Burt Davy*, no. 1659 (Cal.); Sebastopol, Apr. 26, 1893, *Eastwood* (Cal.); OREGON: shallow pool in pasture at end of Brook Lane, Corvallis, April 23, 1934, *Gilkey*. VANCOUVER ISLAND: vicinity of Victoria, *John Macoun*, no. 77,391; Colwood, May 21, 1919, *C. F. Newcombe;* Oak Bay, May 9, 1901, *N. S. Gardner* (Cal.).

Ranunculus Lobbii is one of the most sharply defined of any of the North American *Batrachia*. In the paucity of carpels (3–6), the large glabrous achenes with lateral beaks, and the distinctly tripartite dilated leaves, it stands apart from all the North American members of the group. Gray,[1] who had seen very few specimens of this *Ranunculus*, noted that it had sharply defined style-characters, but that, contrary to what Torrey had earlier (1857) reported, the style was never lateral, either in flower or at a later period. My observations indicate that, at least in fruit, the style-base is usually definitely lateral (FIG. 12) unlike that of the achenes of any other *Batrachium*. In the large size (2.25 mm. ±), the very few achenes, and the distinctly lateral beak in fruit, *R. Lobbii* is clearly separated from the European *R. tripartitus*, considered by many students to be its closest relative. Some of the earlier authors regarded *R. hederaceus* as the nearest relative of *R. Lobbii*, even going so far as to include them under one species; but, again, the fruit characters of *R. Lobbii* and the fact that it usually bears dissected, immersed foliage, though often rudimentary, clearly distinguish it from *R. hederaceus*. *R. Lobbii*, then, is a species endemic to western North America.

It is of interest to note that Hiern[2] originally described this plant as a form under his inclusive *Ranunculus hydrocharis* Spenn. Hiern's plant, which was collected by W. Lobb in Oregon (no. 249), is now in the Kew Herbarium where I have examined it. Apparently *R. Lobbii* centers chiefly upon the coast ranges of Mid-California, although it is also in western Oregon and on Vancouver Island.

3. R. TRICHOPHYLLUS Chaix. Leaves dilated and floating or dissected and immersed, with transitional forms common; dilated leaves variously lobed, chiefly confined to the upper nodes, subtended by broader, less completely adnate and more pubescent stipular sheaths than the dissected leaves; dissected leaves of varying length, shape, and disposition about the stem, usually collapsing out of water; stipular sheaths generally narrow, one-half to completely adnate, except

[1] Proc. Am. Acad. xvi. l. c.
[2] Journ. Bot. ix. loc. cit.

when quite young; upper internodes, petioles and lower leaf-segments often hairy: flowers varying from 0.7 to 1.7 (usually 1.2–1.5) cm. in diameter; petals not usually contiguous, exceeding the calyx by about 2–2.5 times; veins of the petal variable, ranging from 3 to 9 (usually 5–6 for eastern forms and 3–4 for the western ones): stamens 5 to 16 (usually 10–12): carpels 8 to 35 (usually 16–24), with often several abortive at maturity; achenes 1 to 2 (usually 1.25–1.5) mm. long, hairy or not; summit of style mostly deciduous, leaving a short persistent beak subterminal to sublateral in position: receptacle 0.5 to 2.6 (usually 1.–1.5) mm. long, pubescent or not.—A very variable plant found in temperate and cold regions. Its many forms have often been described as distinct species, especially in Europe. In North America at least three varieties and several forms can be distinguished.

R. TRICHOPHYLLUS Chaix, var. **typicus** (Figs. 6, 13). *R. trichophyllus* Chaix in Villars, Hist. Pl. Dauph. i. 335 (1786); Grenier & Godron, Fl. France i. 23–24 (1847); Bab. Man. Eng. Bot. ed. 5: 5–6 (1862); Sm. & Sowerby, Engl. Bot. Suppl. v. no. lxxvii, t. 2968 (1863); Coste, Fl. Fr. i. 22 (1901); Pearsall, Bot. Soc. & Exch. Club Brit. Is. Rep. viii. 818–819 (1928). *R. aquatilis* L., var. γ L. Sp. Pl. i. 556 (1753), in part. *R. foeniculaceus* Gilib. Fl. Lithuan. iv. 261, n. 177 (1782), in part, according to F. N. Williams. *R. divaricatus* Schrank, Baierische Fl. ii. 104, n. 859 (1789), in part, not as interpreted by early European authors. *R. flaccidus* Pers. in Usteri, Ann. d. Bot. xiv. 39 (1795), in part. *R. capillaceus* Thuill. Fl. Env. Paris, ed. 2: 278 (1799), in part. *R. pantothrix* Brotero, Fl. Lusit. ii. 375 (1804), in part, excluding synonyms *R. aquatilis* L., var. β & δ. *R. paucistamineus* Tausch, in Flora xvii. 525 (1834), in part, of English authors. *R. aquatilis* L., var. *brachypus* Hook. & Arn. Bot. Beech. Voy. pt. 7: Calif-Suppl. 316 (1840). *Batrachium trichophyllum* (Chaix) Van d. Bosch, Prod. Fl. Bat. i. 5 (1850). *R. hydrocharis* Spenn., forma *trichophyllus* (Chaix) Hiern, Journ. Bot. ix. 101 (1871). *R. aquatilis* L., var. *Drouetii sensu* Lawson, Trans. Roy. Soc. Can. ii. 45–46 (1884). *R. Porteri* Britton, Bull. Torr. Bot. Club xvii. 310 (1890). *B. pedunculare* Greene ex C. F. Baker, West Am. Pl. ii. 8 (1903), name only; Leaflets Bot. Obs. & Crit. i. 95 (1904). *B. Bakeri* Greene ex C. F. Baker, West Am. Plants i. 7 (1902), name only; Leaflets Bot. Obs. & Crit. i. 95 (1904). *R. aquatilis* L., var. *Bakeri* (Greene) Jepson, Man. Flr. Pl. Calif. 391 (1925). *R. aquatilis* L., var. *pedunculare* (Greene) Jepson, loc. cit. (1925).—A common plant in streams and ponds, from Labrador, Newfoundland, Quebec, and Nova Scotia, occasionally in New England, south to northern New Jersey; Minnesota, Alberta, west to the coast from Lower California to Alaska, south to New Mexico and Arizona; Eurasia; Cape of Good Hope; temperate South America. The following are representative: LABRADOR: Rama, *A. Stecker*, no. 331; Anatolak, *Sewall*, no. 510. NEWFOUNDLAND: in a cold brook four miles northeast of Port à Port, *Mackenzie & Griscom*, no. 10284; Otter Pond Brook, Brig Bay, *Fernald, Wiegand, Long, Gilbert & Hotchkiss*, no. 28248; in dead water near tide-limit, East Brook, St. Barbe Bay, *Wiegand* & *Hotchkiss*, no. 28249; limestone barrens, Sandy (or Poverty) Cove, Straits of Belle Isle, *Pease* & *Griscom*, no. 28243; gravelly margin of brook, flowing through clay, slates, sandstones, and quartzites, Upper Gully, Killigrew's, *Fernald* & *Wiegand*, no. 5420. QUEBEC: Rivière aux Becscies, Anticosti, *Victorin* & *Rolland*, no. 25631; La Madeleine, Gaspé Co., *Rousseau*, no. 31089; in a deep quiet brook, Bradore, Saguenay Co., *Fernald* & *Wiegand*, no. 3407; Five Mile Rapids, Roberval, Saguenay Co., July 16, 1892, *Geo. G. Kennedy;* fresh pools near mouth of Dartmouth River, Gaspé Co., *Collins, Fernald,* & *Pease*, n. 5229; Rivière Petite Cascapedia, Bonaventure Co., *Victorin, Rolland* & *Jacques*, no. 33,822; estuaire de la Rivière York, Gaspé Co., *Victorin, Rolland, Brunel* & *Rousseau*, no. 17352; Sargents Bay, Lake Memphramagog, Aug. 1, 1903, *Churchill;* fresh-water pond near beach at Point Comfort, South Coast, James Bay, *David Potter*, no. 357; environs d'Ottawa, *Victorin*, no. 10084 (U.S.); Lac à la Truite, *Victorin*, no. 11279 (U.S.). PRINCE EDWARD ISLAND: brook near Village Green, Queens Co., *Fernald, Long* & *St. John*, no. 7478, a form with unusual long-segmented, dissected leaves. NEW BRUNSWICK: Nashwaak Bridge, July 20, 1932, *Pease* & *Goodale;* near St. John River above Connors, St. Francis Parish, Madawaska Co., *A. H. Moore*, no. 1302. NOVA SCOTIA: lowlands near Dingwall, Cape Breton Isl., *Nichols*, No. 941; Cape Breton Isl., *Macoun*, no. 19016; muddy lagoon, Charcoal, Pictou Co., *St. John*, no. 1421; pond, North Mountain, Aspy Bay, Cape Breton, July 23, 1909, *Churchill.* MAINE: St. Francis, Aug. 26, 1893, *Fernald;* Fort Kent, 1881, *Kate Furbish*, approaching var. *calvescens.* NEW HAMPSHIRE: Mud Pond, Connecticut Lakes, *Kendall, Goldsborough* & *Doolittle*, no. 1 (U.S.). CONNECTICUT: running brook, Vernon, June 15, 1932, *C. C. Hanmer.* NEW JERSEY: Peters Valley, Sussex Co., June 1, 1895, *Van Sickle* (U.S.). PENNSYLVANIA: without statement of locality or collector, U.S. no. 809. MINNESOTA: Vermillion Lake, *Sandberg*, no. 475 (U.S.). SOUTH DAKOTA: Merritt Ranger Station, Black Hills National Forest, *Murdoch*, no. 4312; Black Hills, near Ft. Meade, *Forwood*, no. 342 (U.S.). ALBERTA: prairie ponds, Castle Hill District, *Marion E. Moodie*, no. 1134 (U.S.); south of Castor, Stettler District, *Brinkman*, no. 2404 (U.S.), an intermediate form between *R. subrigidus* and *R. trichophyllus.* MONTANA: Rattlesnake, Missoula, *Kirkwood*, no. 1123; Jack Creek Canon, *Rydberg* & *Bessey*, no. 4135; Cliff Lake, Madison Co., *Rydberg* & *Bessey*, no. 4133; Swift Current Lake, McDermott, *B. Maguire*, no. 767; Big Fork, Flathead Lake, July 15, 1908, *Mrs. Joseph Clemens;* along Swift Current Creek, below Lake McDermott, Glacier National Park, nos. 16876 & 17430 (U.S.); sloughs, Midvale, *Umbach*, no. 218 (U.S.); Rost (?) Lake, *MacDougal*, no. 674 (U.S.); Flathead Plains, *MacDougal*, no. 456 (U.S.), transitional to var. *hispidulus;* Gallatin River, *Blankinship*, no. 15 (U.S.); Drummond, July 16, 1901, *Scheuber* (U.S.); vicinity of Snyder Lake and along Snyder Creek, Glacier National Park, *Standley*, no. 17959 (U.S.); Gallatin Valley, near

Bozeman, *Flodman*, no. 481 (U.S.); Bigfork, *M. E. Jones*, no. 7997 (U.S.). Idaho: near Lakeview, Kootenai Co., Aug. 1–10, 1892, *Heller;* Hope, Lake Pend d'Oreille, *Sandberg, MacDougal & Heller*, no. 934; forks of St. Mary's River, *Leiberg*, no. 1169, transitional to var. *hispidulus;* ponds at Lapwai Agency, Nez Perces Co., *Sandberg, MacDougal & Heller*, no. 131; Tamarack, Washington Co., *June A. Clark*, no. 174; St. Anthony, *Merrill & Wilcox*, no. 858; Willow Creek, Big Camas Prairie, *Henderson*, no. 3371 (U.S.); valley of Traille River, Kootenai Co., *Sandberg, MacDougal & Heller*, no. 882 (U.S.); Lewiston, Nez Perces Co., *Heller*, no. 3142 (U.S.); near Moscow, June 21, 1894, *Henderson* (U.S.); small pond Cougar Gulch, Coeur D'Alene, *H. J. Rust*, no. 393 (U.S.); Goose Cr., Washington Co., *M. E. Jones*, no. 6137 (U.S.). Wyoming: warm waters of Nez Perces Creek, Yellowstone Park, *Nelson*, no. 6251; Hawks Ranch, twenty-five miles south of Laramie, July 2, 1918, *Churchill;* Soda Butte, *A. & E. Nelson*, no. 5860; Kendall, Sublette Co., *E. B. & L. B. Payson*, no. 2935; Gardiner River, Yellowstone Park, July 26, 1888, *F. H. Knowlton* (U.S.); Norris Geyser Basin, Yellowstone Nat. Park, *Mearns*, no. 3030 (U.S.); Yellowstone Lake, *Tweedy*, no. 906 (U.S.); Glen Creek, Swan Lake, *Mearns*, no. 2903 (U.S.); Plumbago Canon, Aug. 26–27, 1899, *Schuchert* (U.S.). Colorado: below Carson, Gunnison Watershed, *Baker*, no. 320; Lake Creek, *Wolf & Rothrock*, no. 115; in shallow water, Buena Vista, Chaffee Co., *Biltmore Herbarium Colo. Exped.*, no. 3230a (U.S.); Steamboat Springs, *Shear & Bessey*, no. 4034 (U.S.); in Grand Lake, *Shear & Bessey*, no. 3986 (U.S.). Utah: Wasatch Mts., *S. Watson*, no. 14; in pond, Aspen Zone, Twelve Mile Canon, Wasatch Mts., *Tidestrom*, no. 515 (U.S.). Nevada: Ruby Valley, *S. Watson*, no. 14; Truckee River, Reno, *Tidestrom*, no. 10600 (U.S.); Battle Mountain, *A. E. Hitchcock*, no. 589 (U.S.). New Mexico: Chusca Mts., San Juan Co., *A. Wetmore*, no. 532 (U.S.); Rio de las Casas, *Arsène*, no. 19161 (U.S.); Navajo Indian Reservation, in the Tunitcha Mts., *Standley*, no. 7601 (U.S.); Taos, Aug. 8, 1910, *Wooton* (U.S.). Arizona: Little Colorado River, *Goodding*, no. 643; Verde Valley, July 28, 1891, *MacDougal* (U.S.). California: Big Manachi Meadows, *Rothrock*, no. 304; Claremont, Mar. 11, 1896, *Jepson;* Sierra Co., *Lemmon*, no. 3; Bartlett Springs, *Mrs. A. McCallum;* Deer Park, Lake Tahoe Region, *Eastwood*, no. 454; ponds at 1500 ft., Mt. Diablo, *Hall*, no. 1743; Presidio, San Francisco Co., *Michener & Bioletti*, no. 162; Susanville, June 29, 1897, *M. E. Jones;* Sacramento Valley about 5 miles northwest of Hamilton on the road to Orland, Glenn Co., *Heller*, no. 11348; valley of Trinity River near mouth of Willow Creek, Humboldt Co., *J. P. Tracy*, no. 3486 (U.S.); Pine Ridge, Fresno Co., *Hall & Chandler*, no. 328 (U.S.); near Sonoma, *Brewer*, no. 970 (U.S.); Mt. Shasta, Siskiyou Co., July 1–15, 1897, *H. E. Brown* (U.S.); Talmadge's Meadow, San Bernardino Co., *Parish*, no. 3397 (U.S.); Feather River, Plumas Co., June 1878, *Mrs. R. M. Austin* (U.S.); near Three Rivers, Tulare Co., *Coville & Funston*, no. 1208 (U.S.); Cabot Meadow, Stanislaus Forest, Alpine Co., *Eggleston*, no. 9688 (U.S.); Waverley, *J. A. Sanford*, no. 359 (U.S.); Mt. Diablo, Contra Costa Co., *Elmer*, no. 4318 (U.S.); foot of Bloody Canon, Mono Co., July 19, 1889, *Chestnut* & *Drew* (Cal.); Laguna, *Cleveland*, no. 328 (Cal.); Snow Mt., Lake Co., June-Aug. 1892, *Mr. & Mrs. T. S. Brandegee* (Cal.); Noble Mine, San Diego Co., *Chandler*, no. 5502 (Cal.); small pools, Garner Ranch, Hemet Valley, San Jacinto Mts., *Munz* & *Johnston*, no. 5522 (Cal.); shallow pools near east end of lake, Bear Valley, San Bernadino Mts., *Munz*, no. 5706 (Cal.); Pilarcitos Lake and Canon, San Mateo Co., *Davy*, no. 1130 (Cal.); Medicine Lake, Siskiyou Co., *M. S. Baker*, no. 470 (Cal.); Laynes Ranch, April 29, 1909, *K. Brandegee* (Cal.). Oregon: in Des Chutes River, Lapine, Crook Co., *Peck*, no. 9626; Farewell Bend, Crook Co., *Leiberg*, no. 451; east side Harney Valley, *Leiberg*, no. 2372; Multnomah Co., *T. J. Howell*, no. 5; in a pool near Minam River, *Sheldon*, no. 8750 (U.S.); in a sluggish stream near Enterprise, Wallowa Co., *Cusick*, no. 2259 (U.S.); Yamhil Co., *Mrs. B. W. Summers*, U.S. no. 1,391, 372; vicinity of Laidlaw, Crook Co., *Whited*, no. 3067 (U.S.); near Wimer, Jackson Co., *E. W. Hammond*, no. 7 (U.S.). Washington: Waitsburg, *Horner*, no. 41 (U.S.); near Rock Ck., Spokane Co., *Sandberg* & *Leiberg*, no. 90, transitional to var. *hispidulus;* Harrington, Lincoln Co., *Sandberg* & *Leiberg*, no. 320; in slow streams, Falcon Valley, *Suksdorf*, no. 1960, transitional to var. *hispidulus;* Lake Ozette, Clallam Co., *J. W. Thompson*, no. 9420; "Box Canon," Pend d'Oreille River, *Kreager*, no. 395; Tacoma, May 1, 1908, *A. B. Leckenby* (U.S.); Lake Chelan, *Gorman*, no. 785 (U.S.); Ellensburg, *Whited*, no. 325 (U.S.); Lake Kachess, Kittitas Co., July 10, 1900, *H. D. Langville* (U.S.); Pend d'Oreille River, 1861, *Lyall*. British Columbia: near mouth of Downie Creek, *J. M. Macoun*, no. 1129; Salt Spring Island, May 10, 1889, *J. Macoun;* Spencer Bridge, May 28, 1889, *J. M. Macoun*, transitional to var. *hispidulus;* Cameron Lake, Vancouver Isl., *Carter*, no. 220; Sproat Lake Falls, Alberni, Vancouver Isl., May 26, 1917, *Carter*, approaching var. *hispidulus;* near mouth of Downie Creek, *Shaw*, no. 1129 (U.S.); lower Frazer River, 49° N. Lat., 1859, *Lyall*. Alaska: Attu Isl., Aug. 29, 1891, *J. M. Macoun;* Atka Isl., Aug. 26, 1873, *U. S. Coast Survey;* Iliuliuk, Unalaska, 1871–1873, *U. S. Coast Survey;* Iliuliuk, Unalaska, 1871–1872, *M. W. Harrington;* Izembek Bay, Hazen Pt., *Murie*, no. 18; Iliuliuk, Unalaska, *Jepson*, no. 317; near center of W. Boundary of McKinley National Park, *Mexia*, no. 2198 (Cal.). Lower California: San Pedro Martir, May 13, 1893, *Brandegee* (Cal.); mts., northern Lower California, *Orcutt*, no. 501 (U.S.).

The majority of authors who prefer more recent names than *Ranunculus trichophyllus* Chaix base their arguments on the assumption that Chaix's species is little else than a *nomen nudum*. Chaix's publication is as follows: "*trichophyllus* (mihi) Hall. 1162: in rivulis limpidis, Valgaud. Devoluy." It is true that Chaix himself gave no original diagnosis; but there is a definite reference to "Hall. 1162."

This, obviously, refers to Haller, Historia Stirpium Indigenarum Helvetiae Inchoata, ii. 69, n. 1162 (1768). To establish first what Haller was dealing with and at the same time to identify Chaix's species which was based upon it, it is necessary to study Haller's description, which follows:

> 1162. RANUNCULUS caule fluitante, petiolis unifloris, foliis capillaribus, laciniis divergentibus.
> *Foeniculum aquaticum, tertium* Tabernaemont. p. 71.
> *Ranunculus trichophyllos, aquaticus, medio luteus* Columna. *ecphras.* p. 315. 316. *Ranunculus aquaticus, albus, Foeniculi folio* Barrelier. *ic.* 566. Frequentissimus in rivulis quietis, fossisque aqua plenis. A priori 1161 differt flore minori, foliis nulla quidem certa figura circumscriptis, multo tamen brevioribus, divergentibus. Flos similis: tuba maxima.
> β *Foeniculum aquaticum, cornutum* C. B. *Prodr.* p. 73. J. B. III. p. 784.
> *Ranunculus aquaticus, albus, circinnatus, tenuissime divisis foliis, floribus ex alis longis pediculis innixis* Pluknet. p. 311. t. 55. f. 2. Circa *Nidau, Erlach, Mathod*, in fossis quietis. J. B. *Genevae*, C. B. in stagnis prope *Hiltelingen*.
> Priori proximus, folia habet a caule parum recedentia, omnino circulari circumscriptione terminata, lobis densissime congestis, imbricatis. Nolui tamen a 1162 separare.

Unfortunately for clarity's sake, Chaix did not definitely state that, although Haller's no. 1162 included a variety β, he was referring to the "α" variety. Only by inference can it be established that Chaix was referring to the latter under no. 1162, since a reference to a given plant which has one or more varieties is customarily interpreted as applying to the first element. Haller's var. β is quite obviously *Ranunculus circinatus* Sibth., because the reference to Plukenet's plate is also cited by Sibthorp[1] in the original description of *R. circinatus*. Thus, Chaix actually referred to two quite different species. However, it is possible to establish the identity of Haller's var. α, since he cites as synonymous *Ranunculus trichophyllos aquaticus medio luteus* Col. Ecphr. i. 315, t. 316, which, in turn, was listed by Linnaeus under his var. γ. Moreover, the common dissected-leaved plant of Switzerland, whence Haller's typical form of the species came, is that passing as *R. trichophyllus* Chaix, according to Schinz and Keller.[2] Furthermore, *R. trichophyllus* Chaix has been maintained by the majority of European authors as the name for this species, so that it would seem more reasonable to retain it because of its general usage than to discard it as a *nomen confusum*.

[1] Fl. Oxon. 176, n. 503 (1794).
[2] Flora Schweiz, i. 203 (1905).

In this case the sound doctrine of the International Rules of Botanical Nomenclature, "where the consequences of rules are doubtful, established custom becomes law" (Art. 5), surely supports the retention of *R. trichophyllus* in its accepted meaning.

I cannot agree, then, with Williams,[1] who states that there would not have been any obscurity as to the identity of Chaix's plant had the latter referred definitely to Haller's earlier work[2] as Linnaeus does under var. γ: Haller, though setting off a var. β which is certainly what Sibthorp later described as *Ranunculus circinatus*, included under his typical form exactly the same synonyms cited in the previous publication.

With the conception of *Ranunculus trichophyllus* established to exclude *R. Drouetii* F. Schultz and its synonyms, but to include those forms which, in North America, have dilated floating leaves, it is now necessary to determine which plants should be reduced to *R. trichophyllus*.

Ranunculus aquatilis L., var. γ[3] was set off by Linnaeus from the rest of his *R. aquatilis* as a small-flowered form bearing only immersed, dissected foliage which was not of the circinate type. There are now known at least two distinct European species which might have been intended by the Linnean var. γ; but, since the var. γ has not been made the basis of a later-published species, its exact identity does not seem to be of special importance. *R. foeniculaceus* Gilib.[4] was a name accompanied by such an incomplete diagnosis (fide Williams, p. 14 l. c.) that it might apply to *R. trichophyllus*, *R. Drouetii* or *R. circinatus*, although Rouy & Foucaud, in their Flore de France, i. 70 (1893), employed it to supersede *R. circinatus* Sibth., a procedure which had no justification because of the vagueness of Gilibert's description.

Ranunculus divaricatus Schrank,[5] described from Bavaria, is not clearly identifiable. Besides giving a brief and inconclusive diagnosis, Schrank cited as synonyms Haller's no. 1162, which was the basis of *R. trichophyllus*, and a plate of Tabernaemontanus,[6] which was a very poor illustration of something which might have been *R. Drouetii*. Williams, selecting the plate of Tabernaemontanus as the primary basis of Schrank's species, takes up *R. divaricatus* for a species distinct from *R. trichophyllus*. There seems to be no justification for

[1] F. N. Williams, Journ. Bot. xlvi. 14 (1908).
[2] Enumeratio Methodica Stirpium Helvetiae Indigenarum, i. 328, no. 17 (1742).
[3] Sp. Pl. i. 556 (1753).
[4] Fl. Lithuan. iv. 261, n. 177 (1762).
[5] Baierische Fl. ii. 104, no. 859 (1789).
[6] Neuw Kreuterb. 187 (1664).

selecting the plate of Tabernaemontanus to stand primarily for *R. divaricatus.* It shows only the habit, without any of the important diagnostic characters, but it was possibly not the same as *R. trichophyllus.* Beck von Mannagetta,[1] unlike many others in Europe, treats *R. divaricatus* (1789) as doubtfully identical with *R. circinatus* (1794), but too doubtful to displace the later and clearly identifiable *R. circinatus.* Among the important botanists who treated *R. divaricatus* as apparently identical with *R. circinatus,* there may be mentioned Wimmer, Fl. Schlesien, 9 (1835); Koch, Syn. Fl. Germ. i. 12 (1837); Grenier & Godron, Fl. France, i. 25 (1847); Ascherson, Fl. Brandenb. i. 12 (1864); and Suringar, Ned. Kruid. Arch. ser. 2, vi. 386–423 (1895). Since, of the various species to which the name *R. divaricatus* has been applied only *R. trichophyllus* is American, it is obvious that its exact typification, should that seem important, is a European problem. Certain American botanists have, however, complicated matters by employing the name *R. divaricatus,* itself only doubtfully belonging to the strictly European *R. circinatus,* for a North American plant with circinate leaves which appears to be distinct from the Old World species. Thus, for example, Britton & Brown in the first edition of their Illustrated Flora of the Northern United States and Canada (1897) included *Batrachium divaricatum* (Schrank) Wimm. as an American plant; and many other authors have followed this interpretation.

Ranunculus flaccidus Pers. and *R. rigidus* Pers.[2] were proposed as specific segregates from *R. aquatilis* L., as treated by Leysser.[3] Persoon did not cite the synonymy for these plants, merely stating in his letter to Usteri, "Die weitläufigern Beschreibungen mit den Synonymien von diesen und von einigen anderen, mit den hiezu nöthigen Abbildungen, bekommen Sie zu einer anderen Zeit." However, referring to the *R. aquatilis* of Leysser's Flora Halensis, 136–137 (1783), it is found that Leysser treated two varieties, α and β, of the species. Variety α was based on Plukenet's plate,[4] which Sibthorp cited in the original publication of his *R. circinatus.* Variety β, of Leysser's *R. aquatilis,* was the *R. trichophyllos aquaticus medio luteus* Colonna, Ecphr. i. 315. t. 316, which formed the basis of Haller's no. 1162, var. α, and therefore of Chaix's *R. trichophyllus.* Persoon did not actually state with which variety of Leysser's *R. aquatilis* his

[1] Fl. v. Nied.-Österreich, i. 414 (1890).
[2] Pers. in Usteri, Ann. d. Bot. xiv. 38–39 (1795).
[3] Fl. Halensis, 136–137 (1783).
[4] Pluk. Op. i. Phytograph. tab. 55, f. 2 (1691).

R. flaccidus and *R. rigidus* belong. From Persoon's description of *R. rigidus*, "foliis omnibus incisis: laciniis rigidis utrinque compressis, reniformiter divergentibus.", it is apparent that it corresponded to Leysser's *R. aquatilis* var. α. *R. flaccidus*, consequently, was equivalent to Leysser's *R. aquatilis* var. β. Turning to Persoon's Synopsis Plantarum, 105 (1807), it is found that he there included *R. capillaceus* and *R. rigidus*, but no *R. flaccidus*. The description of *R. flaccidus* (1795) and the later *R. capillaceus* (1800) correspond very closely, so that it is reasonable to assume that Persoon intended *R. capillaceus* to supplant *R. flaccidus* as the name for his plant. Thus it is apparent that *R. flaccidus* (as well as the later *R. capillaceus*) is synonymous with *R. trichophyllus*, since Persoon's species was based on the variety β of *R. aquatilis* L., as treated by Leysser, which, in turn, was founded upon *R. trichophyllos aquaticus medio luteus* of Colonna, the basis of Haller's no. 1162 (var. α), and therefore Chaix's *R. trichophyllus*. *R. rigidus* (1795), however, is plainly synonymous with the earlier *R. circinatus* (1794), because of the citation of Plukenet's plate in the descriptions of both plants.

Ranunculus flaccidus Pers. was employed by Asa Gray in the Synoptical Flora of North America, as a variety under his *R. aquatilis* L. *R. aquatilis*, var. *flaccidus* Gray was the common dissected-leaved plant of New England, characterized by its long and few-segmented foliage. Gray's plant was probably identical with my *R. trichophyllus*, var. *calvescens*, which is found chiefly in New England.

Ranunculus cespitosus Thuill. (l. c.), appears, from Thuillier's description, to be a mud-form of some dissected-leaved species, the identity of which is not certain. According to Hiern, *R. cespitosus* might belong to *R. trichophyllus*, *R. Drouetii*, *R. circinatus*, or *R. fluitans*. DeCandolle, however, in his Systema, made *Ranunculus cespitosus* Thuill. a variety (β *caespitosus*) of his *R. pantothrix*. From the description of this plant and from the citation of such synonyms as *R. aquaticus albus circinnatis tenuissimé divisis foliis* Pluk. Alm. 311, t. 55, f. 2, *R.* no. 1162, var. β Haller and *R. rigidus* Pers. (all of which are synonymous with *R. circinatus* Sibth.), it is clear that DeCandolle intended his *R. pantothrix*, β *caespitosus* for the species now generally interpreted in Europe as *R. circinatus* Sibth. In the later Prodromus treatment, DeCandolle included all the species of the group, save *R. hederaceus* and *R. tripartitus*, under *R. aquatilis* L. Thus *R. pantothrix*, β *caespitosus* of the Systema becomes *R. aquatilis*, γ *caespitosus* of the Prodromus arrangement. Although the synonymy of *R. aquatilis*, γ *caespitosus* is somewhat reduced, it is plain from the cited synonyms and the description, that DeCandolle's plant was, also, the same as Sibthorp's *R. circinatus*. The Prodromus treatment is important to North American botanists, since several early students of our floras closely followed DeCandolle. Thus, Torrey & Gray, in the Flora of North America, i. 16 (1838), which was, to use Gray's own words, "hastily compiled," followed the Prodromus arrangement very closely, so that DeCandolle's *R. aquatilis*, γ *caespitosus* (the plant now passing in Europe as *R. circinatus* Sibth.) was included as a member of our flora. Later (1895), Asa Gray,[1] largely drawing upon the conclusions of Hiern,[2] treated *R. aquatilis*, var. *caespitosus* DC. as a "dwarf and condensed form" (under *R. aquatilis* L., and not under *R. circinatus* Sibth. with which DeCandolle's *R. aquatilis*, γ *caespitosus* was identical). Piper,[3] too, has taken up DeCandolle's *R. aquatilis*, γ *caespitosus*, apparently in the same sense as Gray. Just how Hiern reached his conclusions as to the nature of Thuillier's *R. cespitosus* I am not certain. It is evident, however, that at least DeCandolle's *R. aquatilis*, γ *caespitosus* was actually the species now passing as *R. circinatus* Sibth., a strictly European plant.

Thuillier also described a *Ranunculus capillaceus* which appears to have little significance, since it was founded on Haller's no. 1162, the basis for *R. trichophyllus* Chaix. Several years later, in his Systema (1817), DeCandolle took up *R. capillaceus* Thuill. as a variety α of his *R. pantothrix*. DeCandolle evidently considered *R. pantothrix*, α *capillaceus* the same as *R. trichophyllus*, since included in the synonymy of the former was Haller's no. 1162 (var. α), as well as *R. trichophyllus* itself. In the Prodromus arrangement, DeCandolle transferred *R. pantothrix*, α *capillaceus* of the Systema treatment to *R. aquatilis*, α *capillaceus*, which is also clearly synonymous with *R. trichophyllus*.

In the seventh edition of Gray's Manual, 394 (1908), DeCandolle's *Ranunculus aquatilis*, β *capillaceus* was taken up instead of *R. trichophyllus* for the common dissected-leaved plant of the northeastern United States. It therefore included typical *R. trichophyllus* and var. *calvescens*.

Ranunculus paucistamineus Tausch[4] was originally described from a Bohemian plant. Although I have not examined the type, I have

[1] Synop. Fl. No. Am. i. 21 (1895).
[2] Journ. Bot. ix. 100 (1871).
[3] Fl. Wash., Cont. U. S. Nat'l. Herb. xi. 270 (1906).
[4] Flora, xvii. 525 (1834)

been fortunate enough to be able to study an authentic Bohemian specimen of *R. paucistamineus*, named by J. Freyn,[1] which is in the Gray Herbarium. The plant differs at once from *R. trichophyllus* in the elongate fruiting peduncles, the many small achenes crowded upon an elongate (3 mm.) receptacle, and the large, flaring, stipular sheaths. The fruiting characters would hardly place the plant with *R. aquatilis* L., as Freyn maintains, since they are of the *R. circinatus*, *R. Baudotii*, and *R. marinus* circle of affinity. All of these species have elongate fruiting peduncles, many rather small achenes (± 1.25 mm.), a long receptacle (± 3 mm.), and large, well developed stipular sheaths, unlike typical *R. trichophyllus*. I do not propose to go further, at this time, into the relations of these European plants. Suffice it to point out that probably *R. paucistamineus* is not exactly identical with *R. trichophyllus*, as Freyn himself has stated.[2]

It is therefore doubtful if the course followed by Gelert,[3] the Danish monographer, in regarding *R. paucistamineus* as not only including *R. trichophyllus*, but also *R. diversifolius* Schrank, was justified. Gelert is followed, however, by Lindman in his Svensk. Fanerogamflora, 264–265 (1918). Somewhat different is the view held by Pearsall, who maintains that *R. paucistamineus* is an aggregate species of wide range, including *R. Drouetii*, *R. trichophyllus*, and "even larger forms of our (*R. heterophyllus*) var. *submersus* so long as the flowers are not too large." For the present *R. paucistamineus* as described by Tausch and distributed by Freyn in his Flora Exssic. Austro-Hung., will be regarded as something quite different from typical *R. trichophyllus;* but, in the sense of Hiern, or Pearsall, *R. paucistamineus* is in part referable to *R. trichophyllus*. Until the type can be examined, if it still exists, I do not feel that *R. paucistamineus* can be finally referred to *R. trichophyllus*.

Ranunculus aquatilis L., var. *Drouetii* (Schultz) Lawson, as treated by Lawson,[4] was probably a slender form of our typical *R. trichophyllus* (or else the northern *R. trichophyllus* var. *eradicatus*). I have not been able to differentiate clearly among our plants *R. Drouetii* of Europe. The common dissected-leaved plant of the Cascade Mountains, British Columbia, and the Aleutian Islands is typical *R. trichophyllus*, though its northern variety *eradicatus* is also found in Alaska.

Ranunculus aquatilis L., var. *brachypus* Hook & Arn.[5] was described

[1] Fl. Exssic. Aust.-Hung., J. Freyn no. 95.
[2] Freyn, J., Beil. Bot. Centralbl. vi. no. 26: 1 (1881).
[3] Bot. Tidsskr. xix. 26–29 (1894).
[4] Trans. Roy. Soc. Can. ii. sect. iv, 45–46 (1884).
[5] Bot. Beech. Voy. pt. 7; California-Suppl. 316 (1840).

from a Californian plant which had peduncles invariably shorter (less than one inch long) than the leaves, which, in turn, were divaricate. After examining many Californian *Batrachia*, I can find no basis for maintaining this state as a variety.

Batrachium Bakeri[1] and *B. pedunculare*[2] of Greene appear to be two atypical forms of the common *R. trichophyllus;* the fundamental floral and fruiting characters of the plants are nearly identical. Moreover, various plants of *R. trichophyllus* can be recognized which show foliage transitional to *B. Bakeri* and *B. pedunculare*.

Dr. Pennell and Dr. Merrill have kindly lent me the type material of *Ranunculus Porteri* Britton.[3] An examination of the specimen in the Herbarium of the New York Botanical Garden showed a plant with unique, narrowly wedge-shaped foliage unlike any other *Batrachium*. Upon studying the other material, from the Herbarium of the Philadelphia Academy of Sciences, I found that of the three fragments there preserved the one bearing a flower bud had foliage of the normal, long, filiform type usually associated with *R. trichophyllus*. I am inclined to believe, then, in the absence of other plants bearing the peculiar foliage and because at least one fragment bears the nearly normal foliage of typical *R. trichophyllus*, that *R. Porteri* is an aberrant form of *R. trichophyllus*.

In his Manual of the Flowering Plants of California, Jepson (l. c.) reduces *Batrachium Bakeri* and *B. pedunculare* of Greene to varieties under his *Ranunculus aquatilis*. This arrangement was a step in the right direction, though it is doubtful if Greene's so-called "species" are anything more than local forms.

Finally, mention should be made of certain plants from southern California[4] which appear to be referable to *Ranunculus Rionii* Lagger, a species chiefly found in Europe, though certain plants in the Gray Herbarium from eastern Asia also seem referable to it. *R. Rionii* is characterized by small flowers, short-petioled flaccid leaves, and many very small achenes (± 1 mm. long). Whether the Californian plants which I am tentatively referring to this species are introduced or not, I am in no position to decide. Further studies, especially in the field, are necessary to determine this point. For the present, then, it will suffice merely to show that plants have been recognized in North

[1] Leaflets Bot. Obs. & Crit. i. 95 (1904).

[2] Leaflets Bot. Obs. & Crit. loc. cit.

[3] Bull. Torr. Bot. Club, xvii. 310 (1890).

[4] *California:* small branch of Chino Creek, 5 miles northwest of Corona, Riverside Co., *Munz*, no. 5022 (Cal.); sluggish brook east of Puddingstone Canyon, San Dimas, Los Angeles Co., *Munz*, no. 5601 (Cal.); *Lemmon* Herb., Cal. no. 338,356.

America which appear to be referable to the chiefly European *R. Rionii*, which, in turn, is closely related to *R. trichophyllus*.

4. R. TRICHOPHYLLUS Chaix, var. **hispidulus** (E. R. Drew), comb. nov. Plants with emersed, dilated floating leaves; their lobes 3–5, acute or obtuse-rounded at the tips and variously subdivided: floral and fruiting characters as in typical *R. trichophyllus*.—*R. hydrocharis* Spenn., forma *trichophyllus* (Chaix) Hiern, Journ. Bot. ix. 101 (1871), in part. *R. aquatilis* L., "form *heterophyllus*" Gray, Rev. No. Am. Ranunc., Proc. Am. Acad. xxi. 363 (1886). *R. aquatilis* L., var. *hispidulus* E. R. Drew, Bull. Torr. Bot. Club, xvi. 150 (1889). *R. aquatilis* L., var. *heterophyllus* DC. *sensu* Gray, Synop. Fl. i. 21 (1895), non DC. *R. Grayanus* Freyn, Deutsch. Bot. Monatschr. viii. 179–180 (1890). *B. aquatile* Dumortier *sensu* Howell, Fl. Nw. Am. i. 13 (1897), non Dum. *B. aquatile* Wimm. *sensu* K. C. Davis, No. Am. Ranunculi, Minn. Bot. Studies ser. ii: pt. 3. 461 (1900), non Wimm. *R. aquatilis* L., var. *hispidulus* (E. R. Drew) Jepson, Man. Fl. Pl. Calif. 391 (1925). *R. aquatilis* L. *sensu* Jepson, loc. cit., in part, non L.—Plants chiefly of the West, ranging from California to Alaska, east to western Montana, Idaho, and northern Utah. The following plants are representative: MONTANA: Columbia Falls, *R. S. Williams*, no. 991 (U.S.). IDAHO: near Harrison, valley of Coeur d'Alene River, Kootenai Co., *Sandberg, MacDougall, & Heller*, no. 645; forks of the St. Mary's River, *Leiberg*, no. 1169, at least as to the plant with dilated leaves. UTAH: near West Fork of Bear River, Summit Co., *E. B. & L. B. Payson*, no. 4848, distributed as *R. Grayanus* Freyn. CALIFORNIA: Prattville, alt. 4,500 ft., July 5, 1897, *M. E. Jones;* Plumas Co., 1873, *Mrs. M. E. P. Ames, Mrs. R. M. Austin*, sheet no. 135,580 (Cal.); eight miles north of Folsom, *Ramaley*, no. 11309 (Cal.); near summit of ridge between Van Duzen and Mad Rivers, on Dinsmore's Ranch, *J. P. Tracey*, no. 4276 (Cal.), a form somewhat resembling a small *R. peltatus;* floating on water in meadows, Russian River, *Bolander*, no. 3869 (U.S.), distributed as *R. hederaceus* L.; Round Valley, Mendocino Co., 1898, *Westerman* (Cal.); Mad River, near Jarnigans, July 1, 1890, *W. W. Price* (Cal.); Hydesville, Humboldt Co., June 19, 1893, *Blankinship* (Cal.); pond by railroad near Ione, *Greene*, journey of 1889 (U.S.); one mile west of Keystone, Tuolumne Co., *Abrams*, no. 10063 (U.S.); shallow water, Cuyamaca Lake, *Munz & Harwood*, no. 7204. OREGON: Oregon, *E. Hall*, no. 4 and 4a; in ditches, Portland, 1881, *Henderson;* pool by roadside, Salem, *J. C. Nelson*, no. 1070; Guano Ranch, Lake Co., *Coville*, no. 608 (U.S.); in ditches, Woodburn, *Howell*, no. 1779 (U.S.); the Dalles, *Brandegee*, no. 606 (U.S.); in a pond on Walker's Creek, Jackson Co., *Applegate*, no. 2333 (U.S.); Forest Grove, May, 1898, *Kirkwood* (U.S.); brooks near McMinville, *Mrs. R. W. Summers*, no. 5 (Cal.). WASHINGTON: on mud and in shallow water, Falcon Valley, Klickitat Co., *Suksdorf*, no. 10074; White Salmon, *Suksdorf*, no. 1879, a form close to *R. heterophyllus* Web.; in slow streams, Fal-

con Valley, May 28, 1892, *Suksdorf* (U.S.), transitional to *R. trichophyllus;* near Rock Ck., Spokane Co., *Sandberg* & *Leiberg,* no. 90 (Cal.); Walla Walla, *Brandegee,* no. 606 (Cal.); Camano Is., June 1, 1895, *N. S. Gardner* (Cal.); Aghut, Chehalis Co., *Lamb,* no. 1261 (U.S.). BRITISH COLUMBIA: below Sproat Lake Falls, Alberni, July 1916, *Carter,* a form close to the European *R. lutarius* Bouvet; Victoria, May 18, 1895, *Pineo* (Cal.). ALASKA: Nagai Isl., Shumagins, Aug. 2, 1872, *Harrington;* Nagai Isl., Shumagins, Sept. 18, 1892, *Jas. M. Macoun;* neither of the last two seems to be exactly var. *hispidulus,* but, in the absence of clear diagnostic characters, it is perhaps better temporarily to place them here.

Though obviously closely related to certain European plants, this variety does not appear to be identical with any of them. It has most frequently been identified with *R. heterophyllus* Web. of the Old World.[1] Accordingly I have made an intensive taxonomical study, aided by the abundant material at the Kew Herbarium, on the relation of these two forms. In general, *R. heterophyllus* is much larger and coarser than the usual form of our plant. Accompanying this greater size is also a greater number of parts, as frequently in the petals and the stamens. Moreover, the average diameter of the flowers of *R. heterophyllus* is close to 2 cm., whereas the average for our plant is about 0.8 cm. However, only when many specimens are examined does this difference become clear-cut, since small forms of *R. heterophyllus* appear almost inseparable from the larger examples of our *R. trichophyllus,* var. *hispidulus.* Furthermore, the same difficulty arises with smaller specimens of *R. peltatus.* Furthermore, these European dilated-leaved species of the Old World *R. aquatilis* (s. s.) group, *R. heterophyllus* and *R. peltatus,* are there apparently easily separable from *R. trichophyllus,* which is regarded by such careful and authoritative students as Felix[2] and Pearsall as *never*—and they emphatically insist on this word *never*—developing dilated floating leaves. Except for its somewhat dilated leaves, however, our plant is very close to *R. trichophyllus,* and has been regarded as a form of it by Hiern[3] and by Freyn.[4] The closely related *R. radians,*

[1] From the North American material of *Batrachium* in the U. S. National Herbarium, Gray Herbarium, and Herbarium of the University of California, it appears that only one specimen can properly be called a member of the Old World *R. aquatilis* (s. s.) complex. This plant, collected in 1887 at South Hadley, Massachusetts, by A. Clark (U. S. no. 275,313), appears to be referable to the European *R. peltatus* Schrank. Inasmuch as no other specimens of this plant are to be found in the Herbaria cited above, which I have examined, it is probable that this plant of *R. peltatus* is a casual introduction into this country from Europe.

[2] Bull. Soc. Bot. France lx. 260 (1913).

[3] Journ. Bot. ix. 101 (1871).

[4] Deut. Bot. Monatschr. viii. 180 (1890).

R. Godronii and *R. Petiveri* of the European *R. trichophyllus*-plexus certainly develop dilated floating leaves, although typical *R. trichophyllus* itself does not. These species, though closely allied to *R. trichophyllus*, are apparently quite distinct one from the other. Such is not the case with our dilated-leaved plant which in its fundamental fruiting and floral structures seems inseparable from the *R. trichophyllus* of North America. The only consistent feature about it is its geographic distribution: apparently it is never found east of the Rocky Mountain states. It is doubtless better, then, to treat it as a geographic variety.

The first mention of our plant is found in Hiern's account of the "Forms and Distribution of Batrachium" (l. c.). Hiern. simply stated that a form of his *Ranunculus hydrocharis* Spenn., forma *trichophyllus* with floating leaves occurs in California; but he gave this form no name. It seems very significant to me that Hiern, who was perhaps the best informed student of *Batrachia* from a world-wide point of view, should conclude that it was a form of *R. trichophyllus* and not a member of the *R. aquatilis* group (s. s.). Gray, in his revision of the North American *Ranunculi* (l. c.), merely stated that the form "heterophyllus" (the type of Linnaeus's *R. aquatilis*) was distributed from British America and North Alaska to California. He regarded it simply as a member of the *R. aquatilis* complex. A similar interpretation was maintained in the Synoptical Flora. The character upon which *Ranunculus aquatilis* L., var. *hispidulus* E. R. Drew was based, the pubescent under surfaces of the floating leaves and petioles, seems unimportant in view of the fact that such is the condition of normal specimens of the European *R. heterophyllus*, *R. peltatus*, and other dilated-leaved species. Although this variety of Drew's was based upon a weak character, the name which he assigned to it must be taken up, since it is the first one clearly and exclusively pertaining to our plant.

Ranunculus Grayanus Freyn is doubtless our western heterophyllous form of *R. trichophyllus* since it coincides with the latter in taxonomical characters and geographical distribution.[1] It is the correct name for the plant, if treated as a species, as is done by Rydberg and by Tidestrom.

[1] Freyn's opinion of the relation of *R. Grayanus* is significant. He writes in part, "*R. Grayanus* verhält sich zu *R. Godronii* Gren. genau so, wie der ägyptische *R. Aschersonii* m. zu dem Formenkreise des *R. Petiveri homophyllus* und deshalb habe ich die amerikanische Form neu benannt; sie gehört dem engeren Formenkreise des *R. paucistamineus* Tsch. an, nicht jenem des *R. aquatilis* L. p. p., wie ich dieselben in A. Kern. Sched. ad. flor. Austriac. v (1888) p. 38 skizziert habe."

Dr. Porsild,[1] in his studies on the West Greenland flora, has reported a *Batrachium* with dilated-floating leaves which he refers to *R. divaricatus* Schrank. Lacking material of Porsild's plant at the present time, it will be extremely interesting to determine at some future date whether this plant is one of the many European forms or if it is more closely related to our *R. trichophyllus*, var. *hispidulus.*

5. R. TRICHOPHYLLUS Chaix, var. **calvescens**, var. nov. (TAB. 383, FIGS. 8, 9). Var. *typico* similis; receptaculo glabro vel subglabro, acheniis maturis quam in var. *typico* longioribus (plerumque circa 1.5–1.75 mm., in var. *typico* 1–1.5 mm.) laevioribus semperque glabris. —The common form of New Brunswick and New England, south to Pennsylvania and west to Michigan. The following are typical: NEW BRUNSWICK: Bass River, July 27, 1875, *Fowler* (U.S.). NOVA SCOTIA: Shinimikas River, Northport, Cumberland Co., *Fassett*, no. 2250. MAINE: common in gravelly-bottomed streams, Dover, Sept. 1, 1894, *Fernald*, and same region, *Fernald* no. 240; dead water in the river, Milo, Sept. 2, 1897, *Fernald;* mouth of Penjajawock Brook, Bangor, *Fernald*, no. 2693; Dyer Brook, Island Falls, Aug. 28, 1897, *Fernald;* Woodstock, July, 1887, *Parlin;* Pennamaquan River, Pembroke, *Fernald*, no. 1776; clayey brook, Farmington, July 18, 1903, *Knowlton;* Sunkhaze Stream, Milford, July 23, 1892, *Fernald;* Cobossee Contee Lake, Winthrop, Aug. 1898, *T. J. Battey;* sluggish streams, Wells, June 16, 1894, *Parlin;* Hermon Pond, *Knight*, no. 4517; Sebasticook stream, Newport, *C. D. Harvey*, no. 15 (U.S.); shallow water of White's Brook, Seven Islands, Township xiii, Ranges 14 and 15, Aroostook Co., *St. John* & *Nichols*, no. 2292 (U.S.). NEW HAMPSHIRE: Bear Camp River, West Ossipee, Sept. 6, 1855, *W. Boott;* "Weare's Mill," Seabrook, *A. A. Eaton*, no. 33; East Jaffrey, July 6, 1889, *W. Deane* (U.S.). VERMONT: near Isle La Motte, Lake Champlain, July 19, 1878, *Pringle;* West Rutland, Aug. 25, 1895, *Eggleston;* totally submerged, south of Knights Island, Lake Champlain, July 21, 1899, *Brainerd.* MASSACHUSETTS: Crane River, Danvers, July 2, 1885, *J. H. Sears* (TYPE in Gray Herb.), June 10, 1886 and July 5, 1896, *Sears;* brook in Walnut Grove, Danvers, June 10, 1886, *Sears;* brook, near Harrington's, Concord, July 12, 1887, *E. S. Hoar;* Blue Hill Reserv., Randolph, June 22, 1895, *J. R. Churchill;* Purgatory Brook, Norwood, June 17, 1895, *G. G. Kennedy;* Martin's Brook, North Reading, *Pease*, no. 2013; Hunt Place Brook, Randolph, Nov. 11, 1894, *G. G. Kennedy* (sterile); near Green Lodge, Dedham, *C. E. Faxon;* stream flowing into Ward Pond, Becket, July 11, 1909, *Hoffman;* slow stream, Richmond, June 24, 1901, *Hoffman;* West Boxford, *C. N. S. Horner;* stagnant pool, West Quincy, Sept. 3, 1894, *Rich;* brook in meadow, Sharon, July 12, 1896, *Rich;* cold brook, Dover, Sept. 2, 1889, *G. G. Kennedy;* Melrose, July 6, 1876, *Morong;* Mill Pond, North Saugus, *F. S. Collins*, no. 730; Southamp-

[1] Meddel. om Grönl. lviii. 77 (1926).

ton, 1892, *Chapman*, at least as to specimens on the right of the sheet (U.S.); Amherst, Aug. 2, 1881, *B. P. Clark* (B.U.); in brook, West Stoughton, *S. F. Blake*, no. 3682 (U.S.), transitional to var. *typicus*. RHODE ISLAND: Rush Brook Swamp, North Scituate, May 30, 1911, *Floyd & Preston;* Smithfield, *Thurber*. CONNECTICUT: Glastonbury, Aug. 15, 1903, *Driggs;* Beaver Brook, Milford, May 28, 1899, *E. H. Eames;* in running streams, Southington, *L. Andrews*, no. 766; Mianus River, Stamford, *Eames & Godfrey*, no. 8222; New Haven, *D. C. Eaton;* Somers, *Pease*, no. 583; in brooks, common, Southington, June 30, 1896, *Bissell;* small brook, near Dragon's Den, Franklin, June 28, 1905, *Graves;* brooks, common, Southington, *Bissell*, no. 47; Whetstone Brook, Killingly, July 2, 1903, *Knowlton;* brook, Warren, July 18, 1919, *Nichols;* Trout Creek Bridge, Franklin, July 10, 1906, *Woodward;* Bridgeport, June 23, 1885, *A. L. Winton, Jr.* (U.S.); shallow, slow-flowing water of stream, Redding, *Weatherby*, no. 5676 (U.S.). NEW YORK: cold brook near Cohasset on Fourth Lake, Herkimer Co., *House*, no. 6697, a form with achene unusually long-beaked. PENNSYLVANIA: frequent, Chester Co., June, 1858–1864, *S. P. Sharples*, sterile. MICHIGAN: Keweenaw Co., *Farwell*, no. 134.

Although var. *calvescens* is more typical of eastern North America, plants with glabrous achenes and nearly naked receptacles are occasionally found in the West. Usually, however, these western plants have definitely smaller achenes and smaller flowers than var. *calvescens*. Moreover, at the northern limits of its range in New Brunswick and northern Maine, var. *calvescens* makes transitions to typical *R. trichophyllus;* plants from northern Maine will often have few to several hairs on the receptacle, but they never show the densely pubescent condition of the typical form of the species.

6. R. TRICHOPHYLLUS Chaix, var. **eradicatus** (Laestadius), comb. nov. (FIG. 5). Plants with very slender, weak stems usually with many adventitious roots: leaves short, flaccid, filiformly dissected, petioled, with narrow, mostly adnate, hairy or nearly glabrous stipular sheaths: flowers small, 0.7–0.8 cm. in diameter: petals 3–6 (av. 5)-veined: stamens 5–10, varying in length according to their age: carpels 8–20 (usually 12–16), usually hairy when immature; achenes 1–1.5 mm. long, hairy or not, usually quite smooth, with a very short inconspicuous beak: receptacle 0.75–1.5 (av. 1) mm. long, variously shaped, almost invariably long-hairy.—*R. aquatilis* L., var. *eradicatus* Laestadius, N. Act. Reg. Soc. Scient. Ups. xi. 242 (1839). *Batrachium eradicatum* Fries, Bot. Notis. 114 (1843), name only. *B. confervoides* Fries, Bot. Notis. 121 (1845). *R. confervoides* Fries, Summa Veg. Scand. i. 139 (1846). *R. paucistamineus* Tausch, var. *borealis* Beurl. Bot. Notis. 156 (1852). *R. lutulentus* Song. & Perr. in Billot. Annot. Fl. Fr. et Allem. 181 (1859[1]). *B. admixtum* Nyl.

[1] See discussion.

& Saell. Herb. Mus. Fenn. 35 (1859), acc. to F. N. Williams.[1] *R. aquatilis* L., γ. *saganensis* Regel et Radde, Regel, Bull. Soc. Nat. Mosc. xxxiv. pt. 2: 39 (1861). *R. hydrocharis* Spenn., forma *confervoides* (Fries) Hiern, Journ. Bot. ix. 102 (1871). *R. aquatilis* L., var. *confervoides* (Fries) Lawson, Rev. Can. Ranunc., Trans. Roy. Soc. Can. ii: sect. iv. 45 (1884). *R. trichophyllus* Chaix, var. *demersus* N. E. Brown, Eng. Bot. Suppl. 12 (1892), ed. 3, acc. to Williams. *R. divaricatus* Schrank, var. *eradicatus* (Laestad.) Williams, Journ. Bot. xlvi. 21 (1908). *R. flaccidus* Pers., var. *confervoides* (Fries) Hegi, Illus. Fl. Mittel-Europ. iii. 584, fig. 708 k (1912).—Greenland, Labrador, Newfoundland, Quebec (Gaspé Peninsula, anticosti and James Bay); northern Wyoming; Alaska; northern Europe. The following specimens are referred here. GREENLAND: Egedesmindes, lat. 67° 57′ Syddistrikt, July 30, 1924, *A. E. Porsild;* Godhavn, lat. 69° 14′, Sept. 10–20, 1920, *A. E. Porsild;* Queqertarssuag, Nûgâtsiaq, lat. 71° 33′, July 16, 1929, *M. P.* & *R. T. Porsild;* Ingnerit Fjord, Magdläq, lat. 71° 7′, July 12–13, 1929, *M. P.* & *R. T. Porsild;* Tringa Pond, North Star Bay, lat. 76° 30′, *Ekblaw,* nos. 341, 342 and 343. LABRADOR: pool in rocks, Near Island, Seven Islands Bay, Kangalaksiorvik, *Abbe,* no. 325; gneiss plain, Blanc Sablon, *Fernald* & *Wiegand,* no. 3406. NEWFOUNDLAND: open peat bogs among the Silurian hills back of Birchy Cove (Curling), *Fernald* & *Wiegand,* no. 3405; shallow pools, Eddie's Cove, Straits of Belle Isle, *Fernald, Wiegand,* & *Long,* no. 28,245; pond-holes and pools, Sacred Island, Straits of Belle Isle, *Wiegand, Gilbert* & *Hotchkiss,* no. 28,247; shallow pools in swampy clearings and thickets, Bard Harbor, St. John Bay, *Fernald* & *Long,* no. 28,246; peaty depressions in tundra, Schooner (or Brandy) Island, Pistolet Bay, *Pease* & *Long,* no. 28,244; shallow pools near Harry's River, *Fernald* & *Wiegand,* no. 3408, approaching *R. trichophyllus,* var. *typicus;* Quiddy Viddy Lake, Aug. 2, 1894, *Robinson* & *Schrenk;* Exploits River, near mouth of Badger Brook, Aug. 13, 1894, *Robinson* & *Schrenk.* QUEBEC: stagnant water, Cape Chudleigh (Cape Chidley), Hudson Strait, Aug. 5, 1884, *R. Bell;* in shallow water, on granite rocks, Lac Perrée, Tabletop Mts., Gaspé Co., *Fernald, Dodge* & *Smith,* no. 25,755; alpine lake, Tabletop Mts., Gaspé Co., *Fernald* & *Collins,* no. 570; estuaire de la Rivière York, *Victorin, Rolland, Brunel* & *Rousseau,* no. 17,353; Rivière la Loutre, Anticosti, *Victorin* & *Rolland,* no. 25,444, doubtful. WYOMING: Swan Lake Flat, Yellowstone Park, *E. C. Smith,* no. 207 (U.S.), and *E. A. Mearns,* no. 2434 (U.S.), both doubtful. ALASKA: St. Paul Island, *J. M. Macoun,* no. 89,578.

The original description by Laestadius,[2] which was extremely detailed, is significant in evaluating the merit of subsequent treatments of this variety.[3]

[1] See discussion.

[2] N. Acta. Reg. Soc. Scient. Ups. xi. 242 (1839).

[3] "2) *a.* subaquaneus, caule bi 1. 3-pollicari, filiformi; floribus minutissimis, ante explicationem vix semine cannabis majoribus; foliis non proprie capillaribus, sed

It is quite evident from Laestadius's remarks that he believed the filiform and diminutive habit of the plants to be due to ice-action in pulling up the roots so that the new growth arose from the fragments of the old. In other words, he regarded var. *eradicatus* as simply a variation, brought about by the rigors of a subarctic climate, of the usual dissected-leaved European *R. aquatilis.*

It was subsequently pointed out by Fries[1] that Laestadius was dealing with an abnormal state of the plant described by the former as *Batrachium confervoides.* In part Fries writes: "Collatis numerosis et perfectis speciminibus e varietatum numero excludendus omnino est *Ranunc. aquatilis eradicatus* Laest., qui abnormem quidem statum sistit (quare nomen varietatis ad speciem trahere non licet), sed ad speciem carpellis, *B. tripartiti* Reich. Ic. f. 4574 figura exactissime respondentibus, et receptaculo cylindrico-conico diversissimam pertinet."

Thus Fries regarded the plant as a close relative of *R. tripartitus* rather than of *R. aquatilis* L. He was doubtless correct, since the fruit of *R. tripartitus* as depicted in the plate[2] referred to, which closely matched that of *R. confervoides,* is certainly not to be confused with that of *R. aquatilis* L. (s. s.), in which the achenes are larger, more pointed and frequently bear hairs. Whether or not the plant of Laestadius was abnormal, one can hardly say without examination of the original specimen which Fries had evidently studied. It is noteworthy in this connection, however, that the great majority of authentically named specimens of *R. confervoides* possess adventitious roots at many of the nodes, which would indicate that to survive the severe climatic conditions to which they are subjected, the plants necessarily develop these organs, especially when broken off from their weak, primary fibrous roots. Moreover, many specimens exhibit deformed stems so that it is undoubtedly true that ice-action and stranding have an effect on the habit of the next year's growth. Thus perhaps the plant of Laestadius was not so very abnormal, but rather was more severely damaged than usual by ice-activity.

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abbreviatis; radice filiformi, fibrosa. Hab. in stagnis vadosis ex. gr. Karavuopio et Saxajerfvi ad Karesuando Lappon. Tornensis. Caespitose crescit in fundo, quo etiam floret sub aqua, interstitio 3-pedali ex summitate plantae ad superficiem aquae. Aeque memorabilis et omnino constans varietas ac *Nymphaea pumila,* et pari modo orta. Glacies enim radices *Ranunculi aquatilis* funditus evellit; sed reliquiae i. e. *radiculae,* ipsae graciles, gracillimam edunt plantam; quae tali modo diminuta, praecox quoque facta est: Nam *Ranunculus aquatilis vulgaris* nondum explicavit flore, hujus fructibus jam maturis. *Ran. aquatilis* α, saepius in alto et in aqua manante nascitur; unde et serius floret, et folia valde elongata et eximie capillacea habet."

[1] Bot. Notis. 121 (1845).

[2] Reichenb. l. c.

At this point it is pertinent to discuss the characters upon which *Batrachium confervoides* Fries[1] was based, with a view to more clearly establishing its relation to the other *Batrachia*. The habital characters appear to be important, since the filiform, rather short leaf-segments and weak, slender stem are superficially quite different from those of normal specimens of the other European *Batrachia*. Few groups of plants, however, are as polymorphic in their habit, foliage, etc., as the *Batrachia;* and *R. confervoides* of all the aquatic, white-flowered *Ranunculi* has the most severe of environmental conditions. One would, therefore, expect plants of the same species under these conditions to be habitally different from others of their kind growing farther south. Little emphasis can be placed on such characters as specific distinctions unless they are associated with more fundamental differences. Fries's diagnosis is as follows: "Stamina 10–15, ovariorum capitula longiora. Receptaculum conico-cylindricum, longe hirsutum, cum carpellis globosum. Carpella obovato-turbinata, fere aequalia, extus acute carinata, omnino mutica, apice rotundato-obtuso, sursum primo hispidula, demum calva: diu laevia persistentia, ceterisque demum multo obsoletius transverse rugosa." Checking these characters with authentically named European material[2] I find that this diagnosis is essentially adequate. The carpels, however, are not always "sursum primo hispidula" and glabrous at maturity. Careful study shows that the immature carpels are glabrous as often as they are hispidulous; and the mature achenes are pubescent and glabrous in nearly the same ratio. Consequently, little diagnostic importance can be attached to the presence or absence of hairs either on the immature or mature carpels.

The characters of *R. confervoides* which appear to be the more significant are as follows: first, the usually short leaves, and filiform stem: second, the many adventitious roots; and, third, the more or less smooth mature achenes. It seems entirely possible that *R. confervoides* is nothing but the northern form of the ordinary *R. trichophyllus,* the fundamental characters of which, with the possible exception of the smooth achenes, remain practically unobscured even though habital changes have altered the normal appearance. The smooth achenes seem to be the most significant character, but further

[1] Bot. Notis. l. c.

[2] a. In lacu Schwarzee dicto prope Zermatt, Helvetia, alt. 2500 M., *F. Schultz*, herb. norm., nov. ser. cent. 11, no. 1009.

b. Uleaborg; Finlandia, *Dr. W. Nylander*, Jun.

c. E. Lapponia Tornensis, *L. L. Laestadius*.

study of European material is needed to decide as to their constancy and diagnostic value. For the present *R. confervoides* is regarded in this paper as a northern variety, unfortunately not too well marked, of the ordinary European and North American *R. trichophyllus*.

Ranunculus aquatilis, var. *eradicatus* of Laestadius appears to be the earliest name applicable to our plant, even though Fries states that it was applied to a somewhat abnormal form. It does not seem to me, however, that Laestadius' name can be disregarded on the basis of the International Rules of Nomenclature, Art. 51 (no. 3), which states that a name can be rejected if based upon a monstrosity, since, from the description, it is hardly in the latter class. If, however, it should be shown from a first-hand examination of Laestadius' plant, that it may properly be considered a monstrosity, which seems unlikely, the name would have to be rejected.

Following these names comes *Ranunculus paucistamineus* Tausch, var. *borealis* Beurl.[1] which was founded on the earlier (1839) *Ranunculus aquatilis*, var. *eradicatus* of Laestadius; but *R. paucistamineus* by many botanists, including the writer, is regarded as synonymous, at least in part, with *R. trichophyllus* Chaix. Then, in 1859, *Ranunculus lutulentus* was published by Songeon and Perrier[2] as a new species characteristic of the higher altitudes (7000 feet) of Switzerland and Savoy. According to Hiern,[3] who was apparently familiar with specimens of this plant, its habit approached that of *R. confervoides*. In Hiern's treatment, *R. lutulentus* is placed under *R. hydrocharis*, forma *Drouetii* which is extremely close to *R. trichophyllus*. Fortunately, I have been able to study authentic specimens of *R. lutulentus*, named by Perrier, which are in the Gray Herbarium.[4] A careful check of the characters of this plant have brought out the following: flowers 0.8–1 cm. in diam.; petals mostly 5-veined, narrow; stamens 8–10; carpels 16, glabrous; mature achenes rugulose to rugose, rarely smooth, glabrous; leaves short, petiolate, with filiformly dissected segments; stipules small, hairy when young; receptacle hairy. The habit of the plant is perhaps slightly more robust than in *R. confervoides* Fries, but not conspicuously so. All specimens examined, however, gave no indication of the development of the many adventitious roots characteristic of *R. confervoides*.

[1] Bot. Notis. l. c.
[2] Billot, Annot, Fl. Fr. et Allem. l. c.
[3] Journ. Bot. ix. 102 (1871).
[4] a. "Étang de la forêt de Aut-du-pré, au mont Mirantin (Hte. Savoie) E. Perrier, fl. 8bre; fr. 16 jt. 1857."
b. Près Conflans (Savoie), E. Perrier.

With the exception, then, of a few more carpels, slightly more rugose achenes, and the absence of adventitive roots, *R. lutulentus* is nearly identical with typical *R. confervoides.* Indeed, in as far as it differs, it seems to be quite a natural transition to *R. trichophyllus.* Of these two, however, it is obviously closer to *R. confervoides,* and probably ought to be considered as a form of that plant, for it is scarcely worthy of independent varietal rank.

Batrachium admixtum Nylander & Saellan,[1] according to Williams, does not differ in any way from his *R. divaricatus,* var. *eradicatus.* Williams states that *B. admixtum* occurred with *B. confervoides* in the Limingo district of Finland. The chief distinction between *B. admixtum* and the latter species was in the "Folia longius petiolata," which is hardly an important character.

I have also been fortunate enough to be able to examine authentic specimens[2] of *Ranunculus aquatilis,* γ. *saganensis* Regel & Radde.[3] A critical study of Radde's material has failed to show any conspicuous difference between it and *R. confervoides.* It is perhaps slightly more robust but otherwise it is practically identical with the exception of the rugose achenes. Here, as in the case of *R. lutulentus,* the plant is so close to *R. confervoides* that it scarcely seems possible to consider it as anything more than a form thereof. As a matter of fact, the importance of smooth achenes in *R. confervoides* is open to question since some of the European material[4] in the Gray Herbarium bears fruit which is definitely rugulose or rugose.

Ranunculus trichophyllus var. *demersus* N. E. Brown was described from a Scottish specimen which Williams regards as true *R. confervoides.* The very complete description checks exceedingly well with *R. confervoides,* with the exception of no mention of adventive roots. It appears, then, that *Ranunculus trichophyllus,* var. *demersus* is simply a smaller and more slender form of that species, which closely approaches var. *eradicatus.* It is significant to note what Brown has to say further regarding his plant. In part he writes: "From the opinion expressed by Prof. Lange in 'Florae Danicae' Vol. xvi., fasiculus 47, p. 7, it would appear that he inclines to the belief that the Scandinavian *R. confervoides* is a variety of *R. Drouetii,* which also seems to me to be the case, whilst I cannot

[1] Herb. Mus. Fenn., l. c.

[2] In alpibus Sajanensis, ex herbario horti Petropolitani: leg. Radde.

[3] Regel, l. c.

[4] a. In flumina Konkumuans, Lapponia enontekiensis, Iustus Montell, July 31, 1913 (rugose).

b. Uleåborg, Finlandia, Dr. W. Nylander, Jun. (smooth to rugulose).

specifically separate the Scotch plant from *R. trichophyllus.*" It is thus probable that we are dealing here with a form of *R. trichophyllus* which very nearly approximates var. *eradicatus.*

Lawson, in his Review of the Canadian *Ranunculaceae,* took up the name *Ranunculus aquatilis* var. *confervoides* (Fries) Lawson for our plant. *R. aquatilis,* var. *eradicatus* of Laestadius was clearly an earlier name so that it should have taken precedence over *R. confervoides* Fries in Lawson's treatment. Apparently this study of the *Ranunculaceae* in North America was the first to include *R. trichophyllus,* var. *eradicatus* as a component of our flora.

Another combination was published by Williams as *Ranunculus divaricatus,* var. *eradicatus* (Laest.) Williams. This combination in effect crystallizes Lange's earlier opinion (above), since Williams' *R. divaricatus* is probably synonymous with *R. Drouetii* of later authors.

Similarly Hegi, in the Illustrated Flora of Mittel-Europa, iii. 584 (1912), regards *R. confervoides* as a variety of *R. flaccidus* Pers., *R. flaccidus,* var. *confervoides* (Fries) Hegi. However, this varietal combination seems unnecessary because of the priority of Laestadius' varietal name.

Gray did not mention this northern plant until the treatment in the Synoptical Flora where he also included it under *Ranunculus aquatilis* L., as variety *confervoides.*

7. R. **subrigidus**, sp. nov. (Tab. 406, figs. 1, 4, 10). Planta habitu *R. longirostri* similis; foliis omnibus submersis capillaceo-partitis circumscriptione fere orbiculatis subrigidis, foliis inferioribus subsessilibus vel petiolatis, superioribus sessilibus; stipulis villosis amplis tota longitudine petioli adnatis; floribus diametro 1–1.6 (plerumque 1.3–1.5) cm.; petalis 5–7-nerviis quam calyx subduplo longioribus; staminibus 10–22 (plerumque 15); carpellis 30–80 (av. 40) hirtis, stylo longitudine carpellam aequante; acheniis maturis 1–1.5 (av. 1.25) mm. longis glabris vel hirtis, rostello 0.1–0.5 (plerumque 0.25–0.3) mm. longo; receptaculo oblongo vel obovato 1–2.5 (plerumque 1.75–2) mm. longo piloso: caulibus immersis gracilibus plerumque elongatis; pedunculis quam folia plerumque longioribus.—Newfoundland and the Gaspé Peninsula of Quebec, south to western New England, where it is rare; west from Michigan to the Pacific, and south to northern Mexico. The following are representative: Quebec: dans les bras morts de Rivière Petite Cascapedia, *Victorin, Rolland* & *Jacques,* no. 33,337; York River, July 29, 1905, *Williams, Collins,* & *Fernald* (type in Gray Herb.); between the Forks and Brûlé Brook, Little Cascapedia River, *Collins, Fernald* & *Pease,* no. 5007. Vermont: Timmouth Creek, Timmouth, July 25, 1895,

Eggleston; Barnard Pond, Aug. 15, 1892, *Jesup* & *Sargent;* outlet of W. M. Evarts' Pond, Windsor, June 27, 1897, *Eggleston;* Mud Pond, Peacham, Aug. 2, 1884, *F. Blanchard* (U.S.). Massachusetts: Spring Brook Pond, Lanesboro, Berkshire Co., Aug. 15, 1916, *Churchhill.* Michigan: Liver-light Lakes, Iron Co., *F. P. Metcalf,* no. 2223 (U.S.). Manitoba: along line of Grand Trunk Ry., *Sewell, Macoun* & *Herriot,* no. 69,788. Minnesota: Stay Lake, Lincoln Co., *F. P. Metcalf,* no. 1784 (U.S.); Swan Lake, Nicollet Co., *F. P. Metcalf,* no. 44 (U.S.); Muskeg Bay, Lake of the Woods, ½ mile north of the mouth of Warroad River, Roseau Co., *Hotchkiss* & *Jones,* no. 412; Lake of Woods, Flag Island, *F. P. Metcalf,* no. 1534 (U.S.). North Dakota: Wallace, north of Dawson, *F. P. Metcalf,* no. 303 (U.S.); Long Lake, McHenry, *D. C. Mabbott,* no. 349 (U.S.); Driscoll Lake, Napoleon, *F. P. Metcalf,* no. 206 (U.S.); slough 7 miles east of Bismark, *F. P. Metcalf,* no. 354 (U.S.); Leeds, Benson Co., July 13, 1908, *Lunell* (U.S.). South Dakota: creek northeast of Camp Crook, Harding Co., *Vischer,* no. 5 (U.S.); sloughs, Sanborn Co., *Over,* no. 13,814 (U.S.); Beaver Creek, Mayo, Custer Co., *Over,* no. 1742 (U.S.), a somewhat atypical form. Texas: Pecos River, Ft. Smith to the Rio Grande, *J. M. Bigelow.* Assiniboia: Milk River Ridge, *Macoun,* no. 10,043 (U.S.); in pond on prairie, Parkby, June 10, 1905, *W. Palmer* (U.S.); Crane Lakes, June 16, 1894, *Macoun.* Alberta: Nab Pond, Wolf Creek, Craigmyle District, *Brinkman,* no. 594; Bow River Valley, *S. Brown,* no. 678 & 693; Calgary, *Macoun,* no. 18,043 (U.S.); Calgary, near Bow River, *M. A. Barber,* no. 221; Vermillion Lake, *McCalla,* no. 2120 (U.S.); small pond below hotel, Banff, *F. C. Prince;* Athabasca Landing, *A. B. Hitchcock,* no. 12, 099 (U.S.). Montana: Ringling, Aug. 5, 1921, *Wooton* (U.S.); Cliff Lake, Madison Co., *Rydberg* & *Bessey,* no. 4133 (U.S.); Columbia Falls, June 2, 1894, *R. S. Williams;* near inlet, Two Medicine Lakes, *Maguire,* no. 760; Bigfork, *M. E. Jones,* no. 795 (U.S.). Idaho: Henry's Lake, Fremont Co., *Nelson & Nelson,* no. 6799; Soda Springs, June 17, 1892, *Mulford;* Falk's Store, Canyon Co., *Macbride,* no. 301. Wyoming: Encampment, Carbon Co., *Tweedy,* no. 4228 (U.S.); La Barge, Uinta Co., *E. Stevenson,* no. 194 (U.S.); in spring-fed ponds, Evanston, Uinta Co., *Nelson,* no. 7195; Evanston, July 10–12, 1897, *T. A. Williams* (U.S.). Colorado: in Laramie River, Aug. 4, 1891, *Crandall* (U.S.); Fort Collins, *Cowen,* no. 21; Twin Lakes, *Wolf* & *Rothrock,* nos. 112 & 113; in slow running stream, Montrose, Payson, no. 113; Ouray, *Shear,* no. 4145 (U.S.); Colorado Springs, *Curtiss,* U.S. no. 202,203; Cañon City, May 1877, *Brandegee* (Cal.). Utah: Corinne, *A. Wetmore,* no. 418 (U.S.); Rabbit Valley, Aug. 21, 1875, *L. F. Ward* (U.S.). Nevada: Eagle Valley, Ormsby Co., *C. F. Baker,* no. 1052; Wadsworth, *Tidestrom,* no. 10,653 (U.S.). New Mexico: Mimbres River, Grant Co., *O. B. Metcalf,* no. 1047; Trout Spring, vicinity of Las Vegas, *Arsène,* no. 18,326 (U.S.); vicinity of Ute Park, Colfax Co., *Standley,* no. 13,674 (U.S.); Negrito Creek, Aug. 1, 1900, *Wooton* (U.S.); Bartlett Ranch, Colfax Co., Sept. 1, 1913, *Wooton* (U.S.). Arizona: Tuba Oasis, *Clute*, no. 130; Lakeside, White Mts., *G. J. Harrison*, no. 5487 (U.S.), a form somewhat atypical. CALIFORNIA: Borax Lake, *J. Torrey*, no. 4; Lake Merced, San Francisco, July 17, 1892, *Blankinship;* Eagle Lake, Lassen Co., July 23, ? , *M. S. Baker* (U.S.); Shasta River, near mouth, Siskiyou Co., *G. D. Butler*, no. 361 (Cal.); Eagle Lake, July 25, 1894, *Baker* & *Nutting* (Cal.); Yreka, Siskiyou Co., May, 1903, *W. T. Mooney* (Cal.). OREGON: pond, upper gap, Lost River, Cascade Mts., Klamath Co., *Applegate*, no. 3477 (Cal.). WASHINGTON: junction of Crab and Wilson Creeks, Douglas Co., *Sandberg* & *Leiberg*, no. 265. MEXICO: Pacheo, Chihuahua, *Hartman*, no. 680; Sierra Madre, Chihuahua, *E. W. Nelson*, no. 6025 (U.S.); vicinity of Madera, Chihuahua, *Palmer*, no. 262 (U.S.); near Colonia Garcia, Sierra Madre, *Townsend* & *Barber*, no. 115; Rancho Colorado, District of Guerrero, Chihuahua, *Mexia*, no. 2570.

In its typical form (FIG. 1), *Ranunculus subrigidus* is superficially similar to the European *R. circinatus* with which it has long been confused. Upon close study, however, it is found that the larger size of the petals of the European plant and, consequently, the greater number of veins are features which set apart *R. circinatus* from our *R. subrigidus*. Moreover, the veins of the petals of the European *R. circinatus* are usually more forked toward the distal extremity. Further, the leaves of *R. subrigidus* are only subrigid and rather flaccid, whereas those of the Old World *R. circinatus* are usually very rigid and stiff.

In addition to the typical *R. subrigidus*, there are two or three recognizable forms of it. One form, which appears to be common in the southwestern United States, particularly in Arizona, New Mexico, southern Utah, southern Nevada, and northern Mexico has long, flaccid, many-segmented, mostly sessile dissected leaves, the primary divisions of which are often rather elongate. The floral and fruiting structures of this plant, however, appear to be identical with those of the more typical form of *R. subrigidus*. Another form, which seems to me to be more common in California, has more or less flaccid dissected leaves, many of which are often distinctly petiolate; but the more fundamental characters of the plant clearly indicate its affinity to *R. subrigidus*.

The distinctions between *Ranunculus subrigidus* and *R. longirostris* become the more evident the greater the number of plants of each species that are studied. *R. subrigidus* closely resembles *R. longirostris* in habit; but, normally, each species has distinctive fruit characters. For example, *R. subrigidus* has from 30–80 (av. 40) carpels per fruiting head, whereas *R. longirostris* bears from 8 to 30 (av. 16) carpels. The immature carpels of *R. subrigidus* have long styles which do not usually persist to any marked extent at maturity (FIG. 4). The persistent style-bases of *R. longirostris*, on the other hand, are prominent, usually attaining a length of 1 mm. (FIG. 11). The mature achenes of *R. subrigidus* vary in length from 1 to 1.5 (av. 1.25) mm., whereas in *R. longirostris* the range is from 1 to 1.6 mm.; but the average size is about 1.5 mm. Moreover, the receptacle of *R. subrigidus* (FIG. 10), while varying from 1 to 2.5 mm., usually is 1.75–2 mm. in length. In *R. longirostris* (FIG. 14), on the other hand, the size of the receptacle ranges from 0.75 to 2 mm., but usually lies between 1 and 1.5 mm.

8. R. LONGIROSTRIS Godron (FIGS. 2, 11, 14). Plants with dissected immersed leaves only; leaves more or less circinate, definitely sessile, with prominent hairy stipular sheaths usually ½–¾ adnate to the petiole: flowers 1–1.9 (usually 1.6–1.8) cm. in diameter: petal with 4–9 (av. 7) veins at the distal edge of the nectarial pit: stamens 10–18 (av. 15): carpels 8–30 (av. 16), glabrous or pubescent; mature achenes 1–1.6 (av. 1.5) mm. long, exclusive of the persistent style-base which is 0.3–1.5 (av. 1) mm. in length: receptacle 0.75–2 (usually 1–1.5) mm. long, mostly very hairy.—Essai, Mem. Soc. Roy. Nancy, 39, fig. ix. (1839); House, Mem. N. Y. State Museum xv. pt. 1, pl. 79A (1918), as *Batrachium circinatum* (Sibthp.) Reich., and Bull. N. Y. State Museum, no. 254: 339 (1924), as *Ranunculus longirostre* (is). *R. aquatilis* L., δ *stagnatilis* (Wallr.) DC., *sensu* Hook. Fl. Bor.-Am. i. 10 (1829), in part. *Batrachium longirostre* (Godr.) F. Schultz, Arch. Fl. Fr. et Allem. i. 71 (1842). *R. aquatilis* L., var. ? *trichophyllus* Lawson, Monogr. Ranunc. Can. and Adj. Pts. Brit. Am., Proc. & Trans. Nov. Scot. Inst. Nat. Sci. ii. pt. 4: 43 (1869). *R. hydrocharis* Spenn., forma *longirostris* (Godr.) Hiern, Journ. Bot. ix. 100 (1871). *R. aquatilis* L., var. *longirostris* (Godr.) Lawson, Rev. Can. Ranunc., Trans. Roy. Soc. Can. ii. sect. iv: 45 (1884). *R. circinatus* Sibth., *sensu* Gray, Rev. No. Am. Ranunc., Proc. Am. Acad. xxi. 363 (1886), in part. *Batrachium divaricatum* (Schrank) Wimm., *sensu* Britt. & Brown, Ill. Fl. ii. 84 (1897), in part. *B. circinatum* (Sibth.) Reichenb., *sensu* Britt. & Brown, Ill. Fl. ii. 116 (1913) in part.—In quiet waters (calcareous at least in eastern North America) from western Quebec to Oregon; south to Delaware, Pennsylvania, Tennessee, Nebraska, Kansas, Texas, Arizona and New Mexico. The following are representative: QUEBEC: Île Charron, Longueil, *Victorin* & *Rolland*, no. 29,089; dans les îles de Sorel, Île aux Corbeaux, *Adrien*, no. 1974. MASSACHUSETTS: Lake Buel, New Marlboro, *Churchill* (probably). CONNECTICUT: small pond at Lakeville, Salisbury, Aug. 19, 1903, *Bissell;* in several feet of water, Mudge pond, Sharon, *Weatherby* & *Anderson*, no. 5900: Salisbury, June 3, 1931, *Weatherby* & *Drew*. NEW YORK: Cayuga Lake, north of RR. bridge, *Dean* & *Thomas*, no. 4049; in water of Sterling Creek, North Fairhaven, Cayuga Co., *Hughes* & *Douglas*,

no. 4050; "Red-house" bridge, s. Beaver Creek, north of Kingsbury St., Washington Co., July 14, 1900, *Burnham;* ponds along Lake Ontario, Woodville, *House*, no. 8156; slough-hole near Crass River, Canton, *Phelps*, no. 451; slow stream, Pecksport, Madison Co., July 10, 1918, *House;* stagnant pond, South Butler, Wayne Co., *Mac Daniels* & *Munz*, no. 6436; western New York, *Sartwell;* Thousand Islands, Aug. 8, 1879, *L. F. Ward* (U.S.); Sodus Bay, Wayne Co., July 12, 1884, *O. E. Pearce* (U.S.); Oswego River, Minneto, June 24, 1880, *O. E. Pearce* (U.S.); vicinity of Pittsford, Monroe Co., *Killip*, no. 2108 (U.S.). PENNSYLVANIA: shallow pool in Common Creek, Tullytown, Bucks Co., Aug. 4, 1927, *Benner;* Presque Isle, Erie, June 2, 1880, *G. Guttenberg* (U.S.). DELAWARE: Wilmington, *Tatnall.* ONTARIO: Belmont, June 23, 1905, *G. L. Fisher;* in the Rideau River, near Ottawa, *J. M. Macoun*, no. 67,787; stagnant water, Galt, *Herriot*, no. 45; marshes, Wallaceburgh, *Macoun*, no. 33,588; near Sarnia, *Dodge*, no. 26; Squirrel Island, Lambton Co., Aug. 13, 1903, *Dodge* (U.S.); St. Thomas, June 23, 1905, *G. L. Fisher* (U.S.); Wingham, June 25, 1898, *J. A. Morton* (U.S.); edge of old canal, St. Catherine, *McCalla*, no. 377 (U.S.). MICHIGAN: cove in Belle River, St. Clair Co., *Dodge*, no. 25; Vandercook's Lake, Jackson Co., May 29, 1896, *S. H. & D. R. Camp* (U.S.); Port Huron, June 3, 1896, *Dodge* (U.S.); pool nw. of Cedar Springs, June 18, 1897, *C. W. Fallass* (U.S.); Dexter, *Elmore Palmer* (U.S.); shallow streams, Hubbardston, 1880 (U.S.); Elizabeth Lake, Oakland Co., June 8, 1913, *B. F. Chandler* (U.S.); Mill pond, Alma, May 20, 1890, *C. A. Davis* (U.S.). OHIO: Mentor Marsh, Lake Co., July 9, 1923, *R. J. Webb;* East Twin Lake, Portage Co., *R. J. Webb*, no. 1300; Castalia, Aug. 23, 1895, *Moseley* (U.S.); Newark, 1888 (?), *Riddell* (U.S.); Vermillion, Erie Co., May 13, 1889, *L. M. McCormick* (U.S.); Lancaster, *J. M. Bigelow*, U.S. no. 798. INDIANA: four miles east of Russelville in old Bayou of Raccoon Creek, *Grimes*, no. 499; Pine Lake, *Mell*, no. 119 (U.S.); Little Maxincuckee Lake, *Evermann*, no. 680 (U.S.). TENNESSEE: swamps along Cumberland River, 1886, *Gattinger* (U.S.), a semi-terrestrial mud-form. WISCONSIN: shallow water, Lake Wingra, Dare Co., *Fassett*, no. 3526; Whitney's Slough of Green Bay, June 14, 1886, *Schuette;* Milwaukee, *Lapham;* Marshy Lake, vicinity of Delavan, *N. Hollister*, no. 15 (U.S.). ILLINOIS: in shallow water, Stony Island, *Greenman*, no. 2616; in a swamp, Crystal Lake, Urbana, *Gleason*, no. 555; small pond north of Urbana, June 27, 1906, *Gleason;* Dorr's Pond near Mt. Carmel, June 30, 1888, *Schneck;* Lakes, St. Clair Co., May 25, 1877, *Eggert;* Bluffs Lake, *Eggert*, no. 27 (U.S.); near Oquawka, June 30, 1873, *Patterson* (U.S.). IOWA: Fayette, May 1894, *Fink;* Estherville, June 1881, *Cratty* (U.S.); Iowa City, June 19, 1883, *Shimek* (U.S.). MINNESOTA: Minnetonka, July 24, 1891, *Sandberg* (U.S.); Mississippi River, Clearwater Co., *J. B. Moyle*, no. 438; Silver Lake, Otter Tail Co., Aug. 1892, *Sheldon.* MISSOURI: Forest Mill, *E. J. Palmer*, nos. 3783, 2313. SOUTH DAKOTA: mouth of Spring Creek, Roberts Co., *Over*, no. 14467 (U.S.); White, June 17, 1893, *Thornber* (U.S.). Nebraska: Neligh, May 13, 1896, *E. S. Bacon;* Hershey, *Mell*, no. 88 (U.S.); Marsh Lake, *R. Thomson*, no. 26 (U.S.); Willow Lake, *R. Thomson*, no. 123 (U.S.); Petersoon Lakes, *R. Thomson*, no. 333 (U.S.), a sterile plant; in Dismal River, Thomas Co., July 13, 1889, *H. J. Webber* (U.S.); Keya Paha, *F. Clements*, no. 2867 (U.S.); in Lodge Pole Creek near Lodge Pole, Cheyenne Co., Aug. 29, 1891, *Rydberg* (U.S.). Kansas: ponds, Riley Co., *Hitchcock*, no. 976. Texas: Lipscomb, *A. H. Howell*, no. 11 (U.S.); bed of Limpia, *Wright*, nos. 437, 835. Montana: North fork, Iona River, *Scribner*, no. 2; Shields River above Wilsall, *Suksdorf*, no. 97; Ennis, July 27, 1898, *E. A. Maynard;* Boiling River, *P. H. Hawkins*, no. 755 (U.S.). Colorado: pond, Denver, Denver Co., *Duthie & Clokey*, no. 3764; divide between Arkansas & South Platte Rivers, at "Elbert" station on RR., circa 1883, *R. W. Woodward*. Utah: Jordan Valley, *S. Watson*, no. 15; along Sevier River, above Marysville, *Rydberg & Carlton*, no. 6930 (U.S.); Cache Co., June 27, 1897, *J. H. Linnford* (U.S.). Nevada: Mountain City, *Nelson & Macbride*, no. 2202; alkali flat, Elko, *A. E. Hitchcock*, no. 943 (U.S.); in water, vicinity of Cold Creek, *A. E. Hitchcock*, no. 1072 (U.S.), lacking fruit. New Mexico: Rio Mimbres, *Thurber*, no. 216. Arizona: El Paso and Ft. Yuma Wagon Rd. Expedition, *Sutton Hayes*, no. 7. Oregon: Lt. Mullen's Expedition, U. S. no. 801.

Ranunculus longirostris is best treated as a distinct species, endemic in North America, which is closely related to *R. subrigidus* and more remotely to the European *R. circinatus*. The presence of the long, persistent style-base of the mature achene of *R. longirostris* was the fundamental character upon which Godron based the species. The distinctions between *R. subrigidus* and *R. longirostris* have been emphasized in the discussion of the former.

Ranunculus longirostris can be separated from *R. trichophyllus* with little difficulty since the long beak of the achene and the sessile, more or less circinate leaves sharply set it off from the latter. A further rather striking difference between the two species is shown by the broad, hairy, auricled stipular sheaths which characterize the leaves of *R. longirostris*. Only very rarely do the stipular sheaths of *R. trichophyllus* approach the size attained in the long-beaked *Batrachium*. Moreover, the amount of adnation of the stipular sheaths of *R. longirostris* is much less than in *R. trichophyllus* in which the sheaths are mostly completely adnate to the petioles.

Ranunculus longirostris has frequently been confused with one species or another by North American taxonomists. The plant was not recognized as a distinct species until Godron described it from a specimen in Riehl's Herbarium, which was labelled *R. divaricatus* Schrank.[1] The type station is given by Godron as follows: "Hab.

[1] Riehl, pl. exs. no. 52 sub nomine R. divaricati Schranck.

in aquis fluentibus Americae Borealis propè Saint Louis, Missouri." There is no doubt from the clear description and the accompanying plate that Godron was dealing with a typical plant of the species. The early *Ranunculus aquatilis,* δ *stagnatilis* of Hooker (1829) and of Torrey and Gray (1838) included both *R. longirostris,* which had not been recognized at that date, and *R. subrigidus.* Lawson, in his later (1884) studies on the Canadian *Ranunculi,*[1] treated *R. longirostris* as a variety of *R. aquatilis.* From his description it is evident that he was dealing with an abnormal plant of *R. longirostris,* since that species does not appear to develop adventitious roots extensively under normal conditions. In his earlier work (1870),[2] Lawson refers to *R. aquatilis,* var. *trichophyllus*? which, judging from the fact that this specimen was included under *R. aquatilis,* var. *longirostris* of the later publication (1884), was probably the plant treated here as *R. longirostris.* At any event, Lawson was the first North American botanist to recognize this characteristic *Batrachium* as something different from the European *R. circinatus.* In 1886, Gray, in his Revision of the North American *Ranunculi,*[3] studied the *Batrachia* extensively; but he included *Ranunculus longirostris* under *R. circinatus.* Largely following the treatment of Britton and Brown,[4] Davis, in his taxonomic study of the North American *Ranunculaceae,*[5] reverts to the misinterpreted name, *Batrachium divaricatum* (Schrank) Wimm., to include *Ranunculus longirostris* and the exclusively Old World *R. circinatus.* As explained under the discussion of *R. divaricatus,* in relation to *R. trichophyllus,* the former name was misapplied by many continental botanists, including Wimmer, to the true *R. circinatus,* on the basis of the word "tellerförmig" by which Schrank characterized the foliage of his plant. Williams[6] has since pointed out the true nature of Schrank's plant. In the meantime, unfortunately, the misinterpreted European *R. divaricatus* found its way into several North American botanical studies as our circinate-leaved *Batrachium.*

Greene[7] described a *Batrachium usneoides* from a peculiar plant collected at Lake City, Arkansas.[8] I have examined the plant from

[1] Trans. Roy. Soc Can ii. sect iv 45 (1884).
[2] Proc. & Trans. Nov. Scot. Inst. Nat. Sci. ii. pt. iv: 42–43 (1869).
[3] Proc. Am. Ac. xxi 363 (1886).
[4] Ill. Fl. ii. 84 (1897).
[5] Minn. Bot. Studies ii. 460–462 (1900).
[6] Journ Bot. xlvi 14 (1908).
[7] Leaflets Bot. Obs & Crit. ii. 106 (1910).
[8] ARKANSAS: Lake City, *A. H Howeli,* no 606 (U. S.).

the original collection which is now in the United States National Herbarium. A study of this material shows that the young achenes, apparently hitherto unnoticed, are very similar, in having long styles, to those of *R. longirostris*. It seems likely that if mature fruiting specimens of the plant were collected, its close relationship to *R. longirostris* would be evident, since in other characters *B. usneoides* approaches *R. longirostris*. Thus, for example, the much-divided, dissected leaves of *B. usneoides*, unique as far as I know among *Batrachian Ranunculi*, are quite sessile, though primary, secondary, and even tertiary divisions are long-stalked. Moreover, these essentially sessile leaves are subtended by large hairy stipular sheaths of the *R. longirostris* type. For the present, then, *B. usneoides* seems better regarded as a somewhat unusual form of *R. longirostris;* in the event that more complete specimens of this plant are secured, its true affinities will become known.

9. **R. pueblensis,** sp. nov. (Tab. 406, figs. 3, 7). Planta habitu *R. trichophyllo* similis; foliis omnibus submersis capillaceo-partitis sessilibus, segementis primariis longe petiolulatis (0.6–1 cm.); stipulis amplis immaturis connatis; staminibus plerumque circa 10–12; carpellis 10–12, glabris; acheniis maturis longissimis, circa 2.5–3 mm. longis; rostello breve et crasso subrecurvato; receptaculo obovato piloso circa 2 mm. longo. *R. trichophyllus,* var. *mexicanus* Lévl. Bull. Geogr. Bot. xxii. 184 (1912), not *R. mexicanus* Davis, Minn. Bot. St. ii. 487 (1900).—This extremely local plant has been collected from only one station. Mexico: Puente de Animas, alt. 2140 m., vicinity of Puebla, State of Puebla, *Bro. Nicolas,* no. 5948 (type in Gray Herb.).

Although this plant appears to have been collected from only one station in Mexico, it is distinct enough from *R. trichophyllus,* which it simulates in general habit, to be worthy of separate specific rank. The achenes of *R. pueblensis* (fig. 7) are markedly different from those of *R. trichophyllus* (fig. 13), in that they are very large (2.5–3 mm., as contrasted with the usual length of 1.25–1.5 mm. in *R. trichophyllus*) and bear comparatively stout persistent style-bases which tend to be recurved. Moreover, the pattern of wrinkles is much coarser than that of the usual achene of *R. trichophyllus*. Furthermore, the leaves of *R. pueblensis* (fig. 3), though long and more or less flaccid, as in *R. trichophyllus,* are sessile (or rarely short petiolate) at the top of the stipular sheaths; but the primary divisions are long-stalked. The leaves of *R. trichophyllus* are usually very definitely long-petiolate. A complete flower was missing from my specimen, but from the size of the head of stamens and carpels I judge it to be about 1.5 cm. in diameter.

Although *R. pueblensis* has sessile leaves as in *R. longirostris*, its achenes are much larger than those of *R. longirostris* (FIG. 11), 2.5–3 mm. as contrasted with 1.5 mm. in typical *R. longirostris*, and are about half as numerous (8–10 in *R. pueblensis* as against an average of 16 for *R. longirostris*). Whereas the leaves of *R. longirostris*, though usually sessile, are more or less definitely circinate in outline, those of *R. pueblensis* are never of that type. Moreover, the stipular sheaths of *R. pueblensis* are not the broad hairy flaring type found in *R. longirostris*. It appears to me, then, that this Mexican plant is wholly distinct from any known North American and European species. Indeed, the only other species of *Batrachium* in North America which bears large fruits at all comparable to those of *R. pueblensis* is *R. Lobbii*, the achenes of which attain an average size of 2.25 mm. However, the achenes of *R. Lobbii* bear a very small and distinctly lateral beak (FIG. 12), whereas those of *R. pueblensis* possess stout, more or less recurved persistent style-bases, sub-terminal in position. Thus, *R. pueblensis*, like numerous other plants from the vicinity of Puebla, Mexico, is clearly an endemic species.

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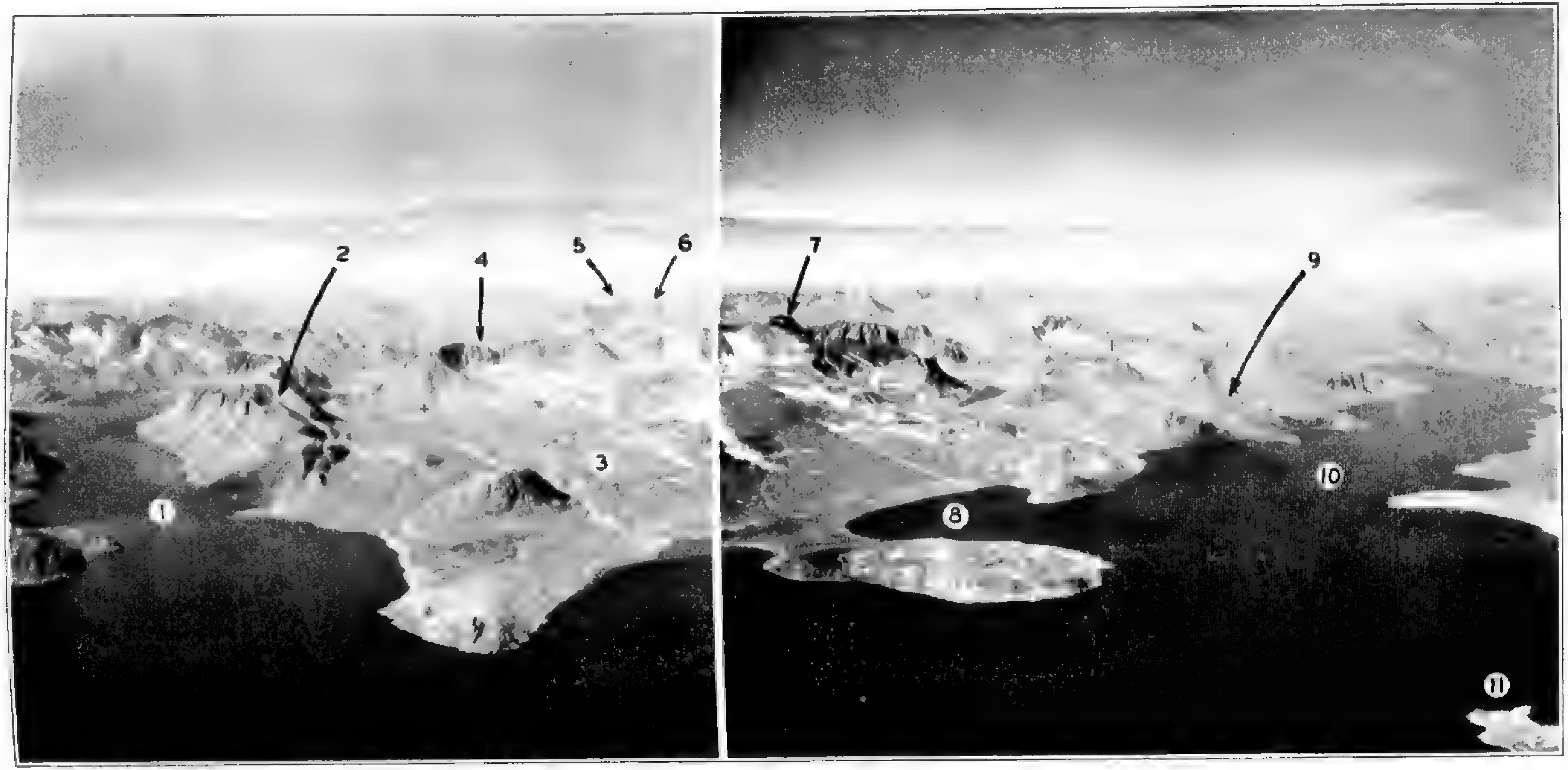
I am especially indebted to several persons who, in many ways, have helped me in the preparation of this paper: to Professor M. L. Fernald for inspiration and thoughtful guidance; to Mr. C. A. Weatherby for many valuable suggestions; to Mr. W. H. Pearsall for instructive advice on the British *Batrachia;* and to my wife for her untiring assistance.

Explanation of Plate 406

FIG. 1, portions of flowering stems, × 1, of RANUNCULUS SUBRIGIDUS n. sp., from TYPE, York River, Gaspé Co., Quebec, July 29, 1905, *Williams, Collins & Fernald;* FIG. 2, portions of flowering stems, × 1, of R. LONGIROSTRIS Godron, from Sarnia, Lambton Co., Ontario, *C. K. Dodge*, no. 26; FIG. 3, portion of stem, × 1, of R. PUEBLENSIS, n. sp., from the TYPE, Puente de Animas, Puebla, Mexico, *Nicolas*, no. 5948; FIG. 4, achenes, × 10, of R. SUBRIGIDUS, from the TYPE; FIG. 5, plant, × 1, of R. TRICHOPHYLLUS Chaix, var. ERADICATUS (Laest.) Drew, from vicinity of Harry's River, Newfoundland, *Fernald & Wiegand*, no. 3408; FIG. 6, receptacle, × 10, of R. TRICHOPHYLLUS, var. TYPICUS, from California, 1864, *Bolander;* FIG. 7, achenes, × 10, of R. PUEBLENSIS, from the TYPE; FIG. 8, achenes, × 10, of R. TRICHOPHYLLUS, var. CALVESCENS, n. var., from the TYPE, Crane River, Danvers, Massachusetts, July 2, 1885, *J. H. Sears;* FIG. 9, receptacle, × 10, of R. TRICHOPHYLLUS, var. CALVESCENS, from the TYPE; FIG. 10, receptacle, × 10, of R. SUBRIGIDUS, from the TYPE; FIG. 11, achenes, × 10, of R. LONGIROSTRIS, from Sarnia, Ontario; FIG. 12, achenes, × 10, of R. LOBBII (Hiern) Gray, from Corvallis, Oregon, April 23, 1934, *H. M. Gilkey;* FIG. 13, achenes, × 10, of R. TRICHOPHYLLUS, var. TYPICUS, from California, 1864, *Bolander;* FIG. 14, receptacle, × 10, of R. LONGIROSTRIS, from Sarnia, Ontario.



Aerial View of Kangalaksiorvik-Komaktorvik Region from the East, 1931 (*courtesy of* Professor Alexander Forbes and The American Geographical Society). Fig. 1, Komaktorvik; fig. 2, K-2 Mountain; fig. 3, K River; fig. 4, Valley of Komaktorvik River (back of first range of mountains); fig. 5, X Peak; fig. 6, Precipice Mountain; fig. 7, Mount Tetragona; fig. 8, Seaplane Cove; fig. 9, Valley of the Bryant Lakes; fig. 10, Kangalaksiorvik; fig. 11, Amiktok.

CONTRIBUTIONS FROM THE GRAY HERBARIUM
OF HARVARD UNIVERSITY

CXI

BOTANICAL RESULTS OF THE GRENFELL-FORBES NORTHERN LABRADOR EXPEDITION, 1931

By Ernst C. Abbe

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BOTANICAL RESULTS OF THE GRENFELL-FORBES NORTHERN LABRADOR EXPEDITION, 1931

Ernst C. Abbe

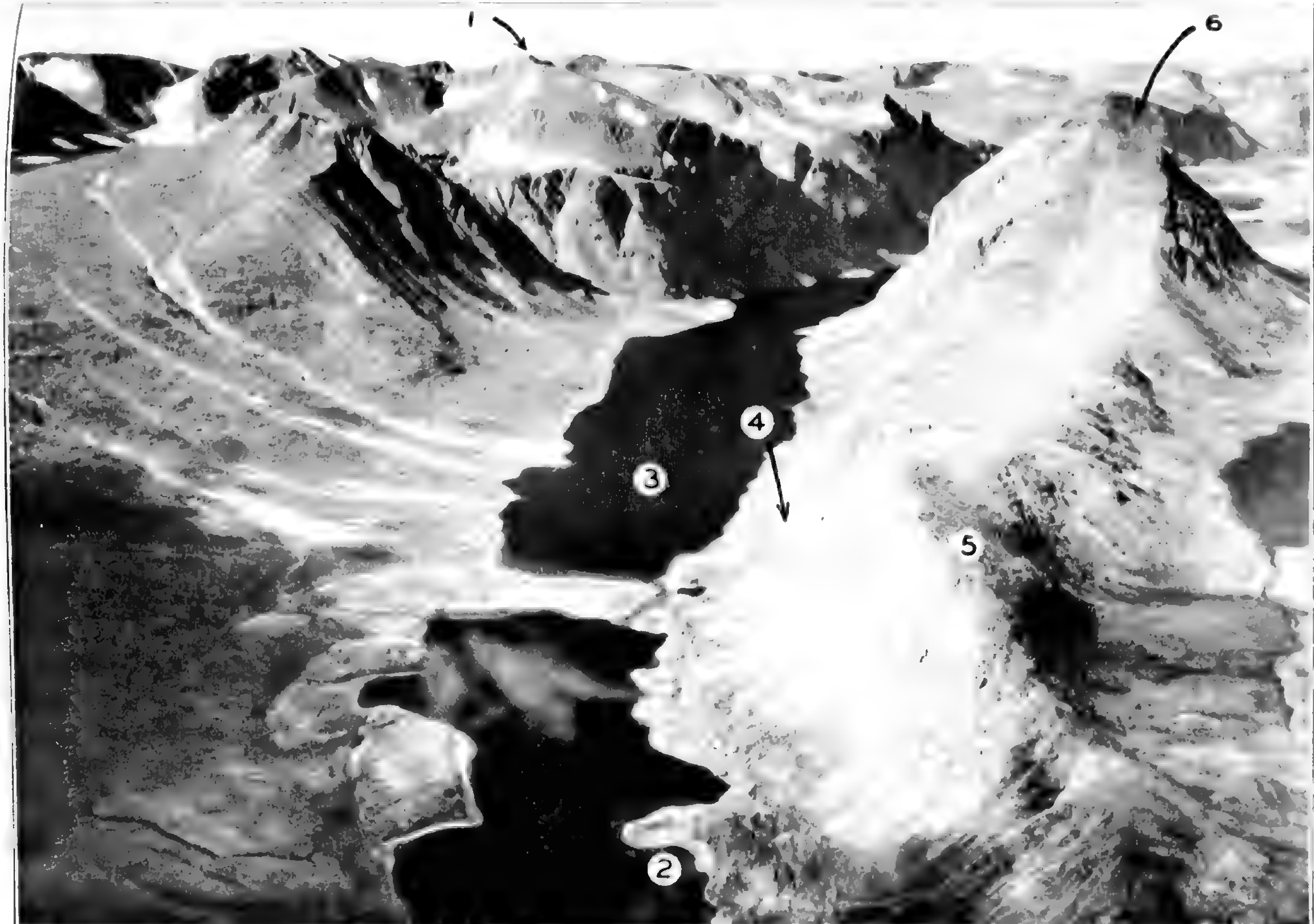
(Plates 408–411)[1]

Introduction

During the summer of 1931, Dr. Alexander Forbes of Harvard University led an expedition to the northeastern part of Labrador, primarily to obtain data for an adequate topographic map of the region. In addition to organizing the expedition, Dr. Forbes also acted as navigator of the *Ramah*, the Nova Scotia-built schooner which was the means of transportation of the expedition. In this difficult task he was ably assisted by Mr. F. T. Hogg, architect, as mate. The direction of the actual surveying (primarily by means of aerial photography) was in the hands of Mr. O. M. Miller of the American Geographical Society, who had just devised a method especially adapted to mountainous country of making maps from aerial photographs, which he calls "plane-tabling from the air." The balance of the scientific staff consisted of Mr. Noel Odell, geologist and mountaineer, who was interested in the structural and glacial geology of the region, and myself who represented the Gray Herbarium as the botanist of the expedition.[2] From the botanical point of view it was considered especially important to investigate the flora at the higher elevations in the Torngat and Kaumajet Mountains because of the current theory that these were not ice-covered during the Wisconsin. It had already been established by Professor Fernald that there is a direct correlation between the presence of "cordilleran" relics and absence of glaciation during the Wisconsin in the more southern nunatak and driftless areas, especially in the Gulf of St. Lawrence region. From earlier collections in northeastern Labrador

[1] The cost of reproduction of the aerial photographs has been met by Professor Alexander Forbes of the Harvard Medical School, organizer and leader of the Expedition. It is a pleasure to acknowledge his generosity not only in this respect, but in numberless other ways both during and after the return of the expedition.

[2] At this point should be mentioned the various members of the expedition who provided valuable aid in collecting plants in the field. These were Mrs. M. Odell, Mrs. M. C. D. Hogg, Miss K. Forbes, Noel Odell, Edwin D. Brooks, Jr., Hott Pease, and Brewster Morris, to all of whom I express my thanks.



AERIAL VIEW OF KOMAKTORVIK LAKE FROM THE EAST, 1931 *courtesy of* Professor ALEXANDER FORBES and THE AMERICAN GEOGRAPHICAL SOCIETY. FIG. 1, N PEAK; FIG. 2, THE CAMP SITE; FIG. 3, KOMAKTORVIK LAKE; FIG. 4, SCREE SLIDE FROM PRECIPICE RIDGE TO THE LAKE; FIG. 5, PRECIPICE RIDGE; FIG. 6, PRECIPICE MOUNTAIN

FIG. 1. MAP OF NORTHEASTERN LABRADOR COMPILED FROM DATA SUPPLIED BY THE AMERICAN GEOGRAPHICAL SOCIETY.

Coast from Button Islands to Nachvak based on a more complete Map by O. M. MILLER at THE AMERICAN GEOGRAPHICAL SOCIETY from data obtained on the Expedition; Nachvak based on preliminary survey of R. A. DALY with corrections by A. P. COLEMAN; south of Nachvak to Okak from sketches of W. T. GRENFELL and others; Okak Region from surveys of E. P. WHEELER, 2d.

it was known that occasional "cordilleran" types occur at localities near sea-level, and it was to be expected that even more might have persisted on or near the mountain tops. On the mountains investigated, this did not prove to be the case. Without going into the matter in further detail at this point it appears that if nunataks existed in northeastern Labrador and were capable of supporting plant life during the height of the last glaciation, they were similar in their sparse flora to the contemporary coastal nunataks of more northern Greenland rather than to the unglaciated Gulf of St. Lawrence areas. The presence of "cordilleran" species in northeastern Labrador thus calls for some other explanation, either by their post-glacial migration or by their persistence in place at low altitudes in the sheltered fiords, *below* the level of the ice. The latter solution appears to be the more reasonable by analogy with Greenland today. This requires further explanation which is reserved until after the current geological theories have been reviewed.

Geology of Northeastern Labrador

Important as a background for the consideration of the flora of northeastern Labrador, especially that of the higher elevations, is the geology and physiography of the region. For the purposes of this article, northeastern Labrador may be considered as that part of the Labrador peninsula north of latitude 57° 30′ and east of Ungava Bay (see map, fig. 1). This includes two major mountain groups, the Kaumajet mountains of the Mugford region, and north of Saglek the various ranges of the Torngat mountains. The western part of northeastern Labrador is an undulating lowland. Fundamentally the entire area appears to be a rolling peneplain which has been elevated on the Atlantic side and depressed on the Ungava Bay side. Remnants of the old land surface are everywhere apparent in the Torngat mountains and often form the restricted flat areas characteristic of the very tops of many of the peaks. This is strikingly apparent from the air, as I had opportunity to observe when I participated in the photographic flight of the afternoon of August third. In the mountains, frost action, erosion, and the activity of ice, both as major factors in shaping the fjords and larger valleys and as minor ones in producing the small hanging valleys, have all had a profound effect on the old land-surface.

That glacial activity was responsible for some of the land-forms in northeastern Labrador has been recognized ever since the early observations of Lieber[1] in 1860. Since that time several geologists including Daly,[2] Coleman[3] and more recently Odell[4] have intensively investigated the geology of the region. But as yet there is increasing difference of opinion in the interpretation of the interplay of forces responsible for the broken topography of the mountains.

The observations of Lieber were limited by the circumstances attendant on an attempt to do geological work on an expedition whose primary purpose was quite different. Furthermore his conclusions were affected by the fact that in the 1860's the interpretation of glacial phenomena was still in the early phase of development when past glaciations were considered in the light of the known behavior of the mountain glaciers of Europe. However as time passed, geologists took the opportunity to study the great continental glaciers, such as those of Spitzbergen and Greenland with the result that major changes occurred in the interpretation of some of the basic phenomena of glaciation. It is, therefore, to the observations of the later geologists that we should turn our attention rather than to those of Lieber and his period. First among these later geologists we should consider Daly, whose masterly work in the Nachvak region in 1900 led him to the conclusion that a general glaciation had not reached above the 1600 to 2100 foot contour in the mountains on the north side of Nachvak. This conclusion was based on the absence of erratics or of *roches moutonnées* above that level and the presence of a more or less continuous *Felsenmeer* composed of deeply weathered and sharp-angled rocks above this level. Daly concludes that the glacial phenomena which he observed could be attributed to the passage of tongues of the major ice-mass of the Labrador glacier through the valleys of the Torngat.

The next major analysis of glacial phenomena was made by Coleman in the seasons of 1915–16, in the Nachvak and Kangalaksiorvik[5] regions. His observations confirmed those of Daly and he also con-

[1] Lieber, O. M. Notes on the Geology of the Coast of Labrador. U. S. Coast Survey Rept. 1860. App. no. 42, 1–7 (1860).

[2] Daly, R. A. The Geology of the Northeast Coast of Labrador. Bull. Mus. Comp. Zool., Harvard Univ., xxxviii. 205–270 (1902).

[3] Coleman, A. P. Northeastern Part of Labrador and New Quebec. Can. Dep. Mines, Geol. Surv. Mem. 124. 1–68 (1921).

[4] Odell, N. E. The Mountains of Northern Labrador. Geog. Jour., lxxxii. 193–210, 315–325 (1933).

[5] Because of a misidentification he refers to Kangalaksiorvik as "Komaktorvik" in his report.

cluded that glaciation in that region of Labrador did not extend above approximately the 2100 foot contour. But he attributed the glaciation to valley glaciers rather than to lobes of the major Labradorean ice-sheet.

Most recently, the researches of Odell, primarily in the coast and central ranges of the Torngat and in the Kaumajet, have led him to conclude that the Labradorean ice-sheet not only reached the Atlantic through the transverse valleys of the Torngats, but that it also completely inundated the Torngat and Kaumajet ranges. His evidence is the occurrence of ice-polishing at practically the summit of the highest peak of the Central Range of the Torngats and *moutonnée* surfaces on one of the highest summits of the Kaumajets. The presence of rounded summits with a covering of rock debris[1] he attributes in a large part to post-glacial weathering[2] which from his observations in the much more recently glaciated mountains of Spitzbergen is quite capable of producing such a condition. Especially would this seem to be the case since the mountain tops of the coastal ranges would have been free of the continental ice for a much longer period of time than were the lower elevations and consequently would have weathered much more than the lower ice-protected surfaces. Also during this period of ice-recession, weathering processes were doubtless even more severe in their action than they are today, and all the geologists who have observed conditions today attest to the violence of even contemporary weathering in northeastern Labrador.

It is beyond the province of this paper to go into further detail concerning the technicalities and interpretation of the glacial phenomena of the region, but it is evident that there are two distinct schools of thought among geologists in their interpretation of its glacial history.

The structural geology of the region has been described in some detail by various geologists, such as Low, Coleman, Daly, Bell, Lieber, and Odell. An excellent review of earlier work is given by Coleman (l. c.). In order to provide an idea of the geological formations at the major centers of botanical collecting on this expedition, the following

[1] Excellent photographs of this condition are given by Odell (l. c., opp. p. 318), by Coleman (l. c., Pl. VIA), and by Delabarre (Bull. Geogr. Soc. Phila., iii.) opp. p. 168 (1902).

[2] That a mantle of this type could even persist at higher levels through a glaciation has been brought out by Hobbs, W. H. The Glaciers of Mountain and Continent. Science, n. s. lxxix. 419–422 (1934).

summary is given, largely based on data very kindly supplied by Mr. Odell.[1]

(Kaumajet Mountains)

The greater part of the Kaumajets is of basic volcanic rock: diabase, basalt, ash, with some peridotite and serpentine (the latter in the Valley of the Twin Falls). The upper part of the Bishop's Mitre has trachytic tuff which is more acid than the magnesium- and calcium-rich silicates of the basement series, which are chiefly granite-gneisses. But between the latter and the volcanics occur in most places, as far as known, about forty to fifty feet of clay-slate of sedimentary origin. It would seem that Daly's Ramah series, extending from Saglek Bay to Nachvak and consisting of slates, quartzites and dolomites, may be the northward continuation of the Mugford slate, but this requires further proof. At most, the Mugford slate attains an elevation of five hundred feet above sea-level in the Mugford region. Its possible northward continuation outcrops at Ramah and Rowsell Harbor. Delabarre mentions a great deal of slate, sandstone, and conglomerate as occurring from about seven miles north of Saglek and reaching beyond Ramah for at least four or five miles. In accordance with these observations, Coleman's map of the "northeastern portion of Labrador and New Quebec" (l. c.) shows the Ramah series as extending directly to the eastern part of the south shore of Nachvak. Thus, a portion of the formation characterizing the Kaumajet region extends locally north into the Torngat region of predominantly Archean formations.

(Torngat Mountains)

Kangalaksiorvik, *Tetragona*, and *The Four Peaks*. The rocks here are garnet granulite, and garnet pyroxene-gneiss with much intrusive aplite and pegmatite, and diabase in dike form. There are also dikes of the rather uncommon hypersthene-gneiss near the "K" river and in the "K" range. The predominating formations of Mt. Tetragona itself are pyroxenite and amphibolite with the garnet pyroxene-gneiss.

Komaktorvik Lake Region. This is predominantly quartz-garnet granulite, with hypersthene-granulite at the summit of "X" peak.

Ikordlearsuk Region. On the east side of the fiord occur hornblende-gneiss and intrusive amphibolite; on the west side, garnet and hornblende and biotite-gneisses and schists. The highest summit of Ikordlearsuk Mt. is garnet biotite-gneiss.

[1] In lit.

The great contrast between the Kaumajet Mountains of the Mugford region and the Torngat Mountains is in the basic, volcanic or sedimentary rocks of the former, underlain by the acid, highly siliceous, metamorphic rocks characterizing the latter.

Botanical Work in Northeastern Labrador

a. Earlier Collections

In contrast to the rather late start made in the middle of the nineteenth century in systematic investigation of the geology of northeastern Labrador stands the pioneer botanical collecting started early in the eighteenth century by the Moravian missionaries. So much progress had been made by 1830 that Meyer[1] was able to publish his remarkably complete flora of the east coast of Labrador. In it he lists 169 different vascular plants from Labrador many of which were collected in the vicinity of the Moravian missions at Okak and Nain, by the resident missionaries. These collections were apparently made with the idea of eking out the slender funds of the "Unitas Fratrum" by their sale, especially in central Europe They were accordingly sent to the central offices of the Mission in Germany from which they were distributed. An excellent account of the early activities of these Moravian missionaries as plant-collectors is given by M. P. Porsild.[2] The botanical tradition established and carried on by such Moravian brethren as Hertzberg, Weiz, and Stecker is today ably maintained by the Rev. P. Hettasch who is an excellent collector and has contributed to the Royal Herbarium of Kew. It was a real privilege to have had the opportunity of seeing his rock-garden of native plants at Nain, and to have seen his herbarium representative of the local flora. In addition to the numerous collections made by the Moravian missionaries in the last hundred and fifty years, there have been collections made by occasional visitors to the east coast of Labrador, notable among whom are Sornborger,[3] Low,[4] Delabarre,[5] Woodworth,[6]

[1] Meyer, Ernst. De Plantis Labradoricis. Lipsiae (1830).

[2] Porsild, M. P. On some Herbaria from Greenland and Labrador collected by the Moravian Brethren. Meddel. om Grønl., xciii. no. 3, 84–94 (1935).

[3] Fernald, M. L. and Sornborger, J. D. Some recent Additions to the Labrador Flora. Ottawa Naturalist, xiii. 89–107 (1899).

[4] Low, A. P. Report on explorations in the Labrador Peninsula. Geolog. Surv. Can., pt. L, Ann. Rept., n. s., viii. 1–43 (1896).

[5] Delabarre, E. B. Report of the Brown-Harvard Expedition to Nachvak, Labrador in the year 1900. Bull. Geogr. Soc. Phila., iii. 65–212 (1902).

[6] Woodworth, R. H. Interesting Plants of Northern Labrador. Rhodora, xxix. 54–57 (1927).

Bishop,[1] and Wetmore.[2] Of these, only Delabarre appears to have collected from higher altitudes, primarily on Mt. Faunce north of Nachvak. In general, then, the flora of the east coast of Labrador at the lower elevations is by no means poorly known while that of the mountains has just barely been sampled. The significant phytogeographical features provided by the flora as then known are given by Professor Fernald in his memoir[3] on the persistence of plants in the unglaciated regions of North America.

B. General Objectives and Itinerary

It was with the idea of obtaining significant and representative plant-material especially from the higher altitudes in the Torngat and Kaumajet mountains that I represented the Gray Herbarium as botanist on the Grenfell-Forbes Expedition. Fortunately the summer of 1931 was unusually open, with but little snow even near the tops of the mountains (see Plates 408, 409, 411). Judging from the accounts of other expeditions to northeastern Labrador it is doubtless the occasional summer snow storms on the mountains which discouraged extensive collecting from them. In addition, the tradition had become well established that the mountains of northeastern Labrador are very high and difficult to climb.[4] This is by no means the case, as the writer found under the skilful guidance of Mr. Odell.

While intensive collecting from the higher elevations was kept in view as the main objective, collections were made elsewhere as opportunity arose, with especial emphasis on the *Gramineae, Carex, Salix Draba, Arnica, Antennaria*, and *Taraxacum*.

The botanical collecting was done on thirty different days between June 28th and August 30th, although these were not always full collecting days, since the exigencies of travel often left for botanizing only the short time between making harbor and dusk. More time was available at the main centers of collecting which were at Ikordlearsuk, Kangalaksiorvik (Plate 408), Komaktorvik (Plate 408), Komaktorvik Lake (Plate 409), and the Mugford region (Plates 410 and 411). General descriptions of the course of the expedition have

[1] Bishop, H. The Austin Collection from the Labrador Coast. Rhodora, xxxii. 59–62 (1930).

[2] Wetmore, R. H. Plants of Labrador. Rhodora, xxv. 4–12 (1923).

[3] Fernald, M. L. Persistence of Plants in Unglaciated Areas of Boreal America. Memoirs of the Gray Herbarium of Harvard University. II. (1925).

[4] Bent, A. H. The Unexplored Mountains of North America. Geogr. Rev., vii. 403. (1919).

Locality	Date		Latitude °	Latitude ′
Ikordlearsuk Mountain		Aug. 14	60	02
East Bay, Ikordlearsuk ("Ekortiarsuk")	Aug. 12		59	59
Ryan's Bay	Aug. 10		59	35*
"Peak 19, The Four Peaks"	Aug. 4		59	28
"Near Island" (Amiktok Island), Seven Islands Bay, Kangalaksiorvik (11, Pl. 408)	Aug. 6		59	25
North Shore of Kangalaksiorvik[1]	Aug. 4		59	24
South Shore of Kangalaksiorvik (Seaplane Cove) (8, Pl. 408)	Aug. 6 July 22	Aug. 16	59	23
"Valley of the Bryant Lakes," Kangalaksiorvik (9, Pl. 408)		Aug. 16	59	21
Mount Tetragona (7, Pl. 408)	July 26		59	19
"K-2 Mountain," north shore of Komaktorvik (2, Pl. 408)	July 24		59	18
"Valley of the K River" (3, Pl. 408)	July 22, 24		59	18
Valley of the Komaktorvik River (4, Pl. 408)	Aug. 1		59	14
Razorback Harbor		Aug. 17	59	12
"Precipice Ridge" (5, Pl. 409)	July 29		59	11
"Precipice Mountain" (6, Pl. 409)	July 29		59	10
Komaktorvik Lake (3, Pl. 409)	July 30		59	10
"X Peak" (1, Pl. 409)	July 30		59	08
Nachvak		Aug. 18	59	05
Rowsell Harbor	July 20		58	58
Kikkertaksoak Island, Saglek Bay		Aug. 19	58	34
The Bishop's Mitre (3 and 4, Pl. 411)		Aug. 21	57	36
Ogualik Island (5, Pl. 410, and 2, Pl. 411)		Aug. 21	57	56*
"Valley of the Twin Falls," Cape Mugford (4, Pl. 410)	July 17		57	50*
Nain		Aug. 23	56	33*
Kikkivitak Island, Ittekaut Bay		Aug. 24	56	21*
Hopedale	July 13		55	26
Aillik	July 10		55	09
Indian Harbor	July 8		54	25
Gready Island	July 5, 6		53	48*
Hawkes Island	July 4		53	05
Battle Harbor	July 3	Aug. 30	52	19
St. Anthony, Newfoundland	June 30 July 1		51	21
Keppel Island, Ingornachoix Bay, Newfoundland	June 28		50	40*

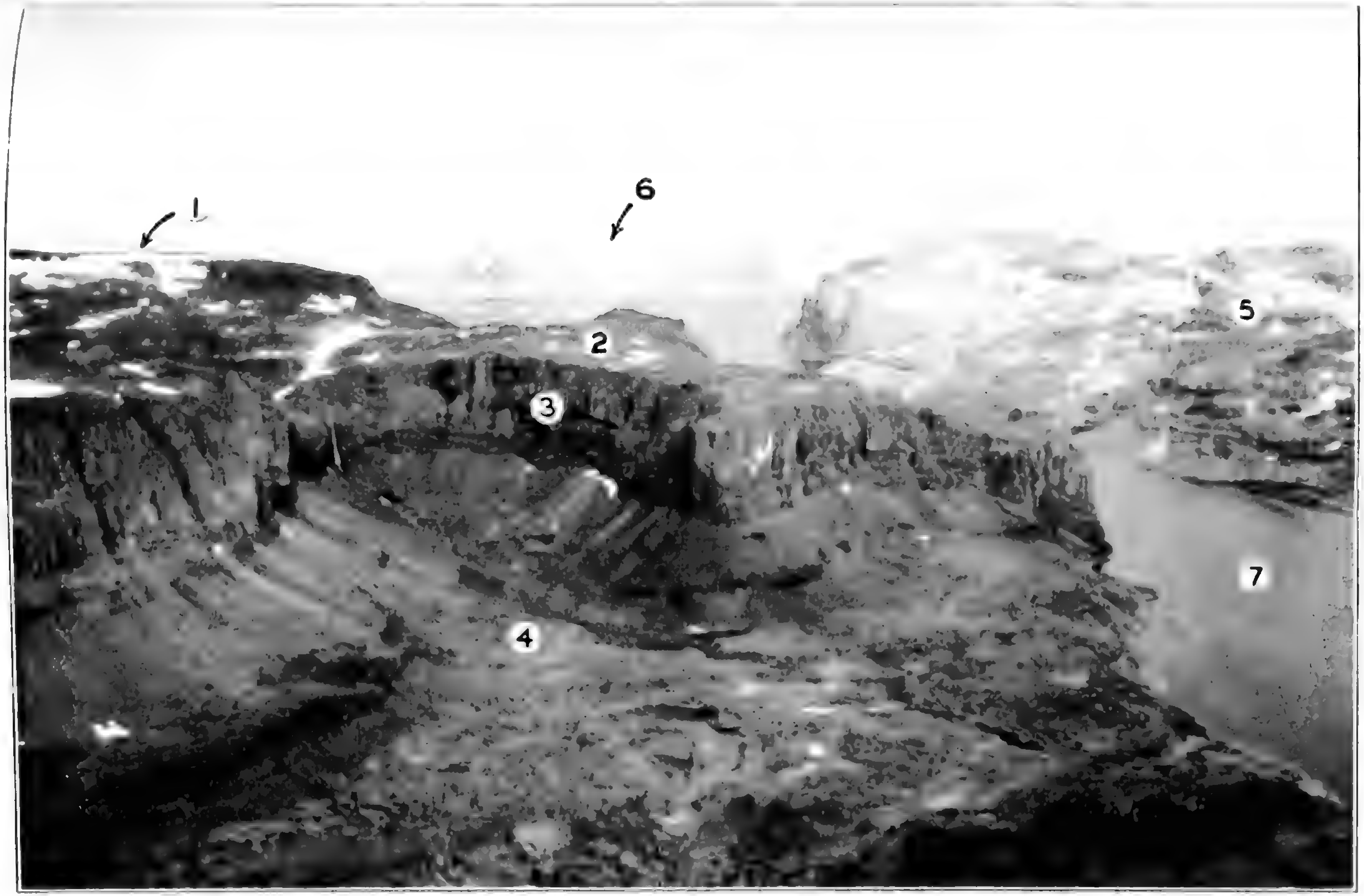
Names in quotation-marks are provisional for localities otherwise lacking accepted designations.

Latitudes, unless marked (*), have been checked through the kindness of Mr. O. M. Miller of the American Geographical Society and supersede the latitudes given on the plant-labels, where these differ.

been given by Dr. Forbes elsewhere,[2] but since the activities of the various members of the expedition were often diverse, the preceding

[1] Kangalaksiorvik is the Komaktorvik of Coleman (l. c.).

[2] Forbes, A. Surveying in Northern Labrador. Geogr. Rev., xxii. 30–60 (1932).
———. An aerial Survey in Northern Labrador. Harvard Alumni Bulletin, 917–923 (1932).
———. A Northern Labrador Cruise. Yachting, liii., nos. for March, April and May (1933).



Aerial View of Valley of the Twin Falls, Kaumajet Mountains, from the Southwest, 1932 (*courtesy of* Professor Alexander Forbes). Fig. 1, the Upper Ridge above the Valley; fig. 2, the Lower Ridge; fig. 3, Gully from the Lower Ridge to the Valley; fig. 4, the Valley of the Twin Falls; fig. 5, Ogualik Island; fig. 6, Nannuktok Island; fig. 7, Mugford Tickle schedule has been prepared to indicate the dates when collections were made at the different stations, and the latitudes of these stations. By reading up the left-hand column of dates and down the right-hand column a general idea of the itinerary may be gained. The arrangement of the stations in a linear succession from north to south has thrown the dates out of the order because of the trip made inland to Komaktorvik Lake late in July.

C. General Considerations concerning the Flora of Northeastern Labrador

Excellent general descriptions of the flora of northeastern Labrador are to be found in the works of Delabarre,[1] Low,[2] Coleman,[3] and others. As pointed out by Macoun and Malte,[4] the northern part of Labrador is in the Arctic zone of Canada. The southern extent of this zone in northeastern Labrador is determined by tree-line, and, as Low (l. c., p. 30) describes it from his personal observations, this extends from about the mouth of the George River on Ungava Bay turning south-southeast just west of the Torngats and runs more or less parallel to the east coast of Labrador to about Hebron where trees first appear near the coast. Really continuous forest does not come out to the coast until much farther south.[5] An opportunity to check on the northern limit of trees near the mouth of the George River was afforded when I accompanied the photographic party on a flight from Kangalaksiorvik south to Nachvak, thence west to the mouth of the George River, north along the shore of Ungava Bay to the Button Islands, and south over the Torngats back to the base at Kangalaksiorvik. On the leg of this flight extending from Nachvak to the mouth of the George River especial watch was kept for any evidence of trees. From the altitude (about 5,000 to 6,000 feet) at which the flight was made, the most striking feature, because of its rarity, was the occurrence of any color other than the gray of the apparently bare land-surface or the blue of the numerous lakes Two general shades of green stood out in this way. Much restricted areas of a yellowish

[1] Delabarre, l. c., p. 167–206; see also Delabarre's chapter on the Flora of Labrador in Grenfell, W. Labrador. New York (1913).

[2] Low, A. P. l. c.

[3] Coleman, A. P., l. c. p. 16–18.

[4] Macoun, J. M. and Malte, M. O. The Flora of Canada. Can. Dept. Mines, Geol. Surv. Museum Bull, no. 26 (1917).

[5] For a description of the wooded conditions near Nain see: Wheeler, E. P., 2nd. Journeys about Nain. Geogr. Rev. xx. 454–468 (1930).

green characterized the heads of the larger lakes in the central range of the Torngats, which experience on the ground indicated was due to grassy, meadow-like areas with occasional willow and alder thickets. But in the rolling hills of the lowland west of the Torngats this yellow-green gave way to a blue-green in the moist, protected heads of lakes. This color may well be interpreted as representing restricted groves of conifers (presumably larch and spruce), especially since the only shadows (other than those caused by the mountains) which were noted on the flight were cast by scattered individuals at margins of such "groves." This substantiates Low's observations. It would seem that the tree line[1] comes a few miles north of the mouth of the George River in the rolling lowlands west of the Torngats. It is then deflected south at least as far as Nachvak in the central range of the Torngats.

From the air there was no evidence of vegetation other than at the heads of lakes. The predominant colors were varying shades of darker gray where the snow had been absent for longer periods of time, and a harsh, light gray where the snow or ice had just recently melted (as indicated by the presence of snow-banks immediately adjacent to many such areas). Closer investigation had already shown that these harsh, light gray areas were generally devoid of vegetation, since apparently they were exposed only when the summer was as *relatively* mild as during the season of 1931.

The greater part of the ice- and snow-free country (which appeared a warmer gray from the air) is covered, especially at the lower elevations, with the ubiquitous tundra, the flora of which is well known. Where the drainage is too good for vascular plants to flourish, lichens and, to a less extent, mosses thrive, while in the moister areas they form the background for the vascular plants. Wherever there is just sufficient moisture for the more hardy vascular plants to exist, an occasional *Hierochloë alpina, Luzula confusa* or *Cardamine bellidifolia* will manage to survive. Sometimes only one or two of such plants are to be found on the fragment of an old peneplain forming the summit of a higher mountain. The flora of these mountain tops is indicated in detail in Table I. At lower altitudes, on the ridges or upper slopes of the mountains, a richer flora appears (see Table II) but the hardy species occurring on the mountain tops are present again at these lower elevations, plus some of the fairly hardy plants from below.

[1] Or at least the northern limit of the ecotone between forest and tundra.

Similarly on talus-slopes and in gullies (see TABLE III) one finds most of the plants of the mountain tops and higher slopes, with the addition of some of the ubiquitous tundra species. Then near sea-level there is the richest flora, including most of the hardy species from higher levels plus the tundra, strand, meadow, or outwash-plain species, depending on the combination of environmental circumstances. The striking feature of the flora is the absence of a clear-cut altitudinal separation of the hardier species. The plants of the mountain tops are to be found in the proper habitats all the way practically to sea-level. Nor is this an isolated observation on the behavior of arctic plants; Raup[1] remarks on it with reference to the appearance of arctic species at river-level in the Canadian Rockies; Devold and Scholander[2] observed it in Southeast Greenland; Simmons[3] notes that altitude is of little very consequence in Ellesmereland.

An interesting sidelight on the ability of plants to survive under adverse conditions is provided by an analysis of the species growing on the margins of soil polygons. The best developed soil polygons[4] were found on Ikordlearsuk Mountain and on the upper ridge above the Valley of the Twin Falls at Cape Mugford. The polygons rarely occur singly, and more commonly are in groups, each individual crowded closely against its neighbor. The polygons are cauldron-like areas about three feet in diameter with finely comminuted country rock slowly churning about vertically under the influence of frost-action.[5] In the most active portions of these polygons, at their centers, no plants of any kind occur, but at their margins, where the rock-fragments are somewhat larger, a few hardy species of plants manage to maintain a foothold. This flora was relatively rich at the Mugford locality where the following species of plants occurred on the margins of the polygons: *Carex misandra, Salix herbacea, Salix Uva-ursi, Papaver radicatum, Arenaria sajanensis, Sagina nivalis, Cardamine bellidifolia, Draba nivalis* and *Vaccinium Vitis-Idaea* var. *minus*. At

[1] Raup, H. M. Phytogeographic Studies in the Peace and Upper Liard River Regions, Canada. Contr. Arnold Arboretum, Harvard Univ. No. VI, 63 (1934).

[2] Devold, J. and Scholander, P. F. Flowering Plants and Ferns of southeast Greenland. Skrifter om Svalbard og Ishavet. No. 56, 170 (1933).

[3] Simmons, H. G. The Vascular Plants in the Flora of Ellesmereland. Rep. Sec. Nor. Arc. Exp. "Fram" 1898–1902. No. 2, 8 (1906).

[4] For further mention of these see Odell, l. c.

[5] For a consideration of the mechanics of soil polygons see:
Huxley, J. S. and Odell, N. E. Notes on surface Markings in Spitsbergen. Geogr. Jour., lxiii. 207–229 (1924).
Elton, C. S. The Nature and Origin of Soil-polygons in Spitsbergen. Quart. Jour. Geol. Soc. London, lxxxiii. 163–194 (1927).

the much more northerly station of Ikordlearsuk, the soil polygons on the first summit (alt. ca. 2250 ft.) of Ikordlearsuk Mountain had only *Luzula confusa* and *Cardamine bellidifolia* growing very sparingly at their margins; while on the second peak (alt. ca. 2800 ft.) *Poa glauca*, *Luzula confusa*, and *Papaver radicatum* occurred, but no *Cardamine bellidifolia*.

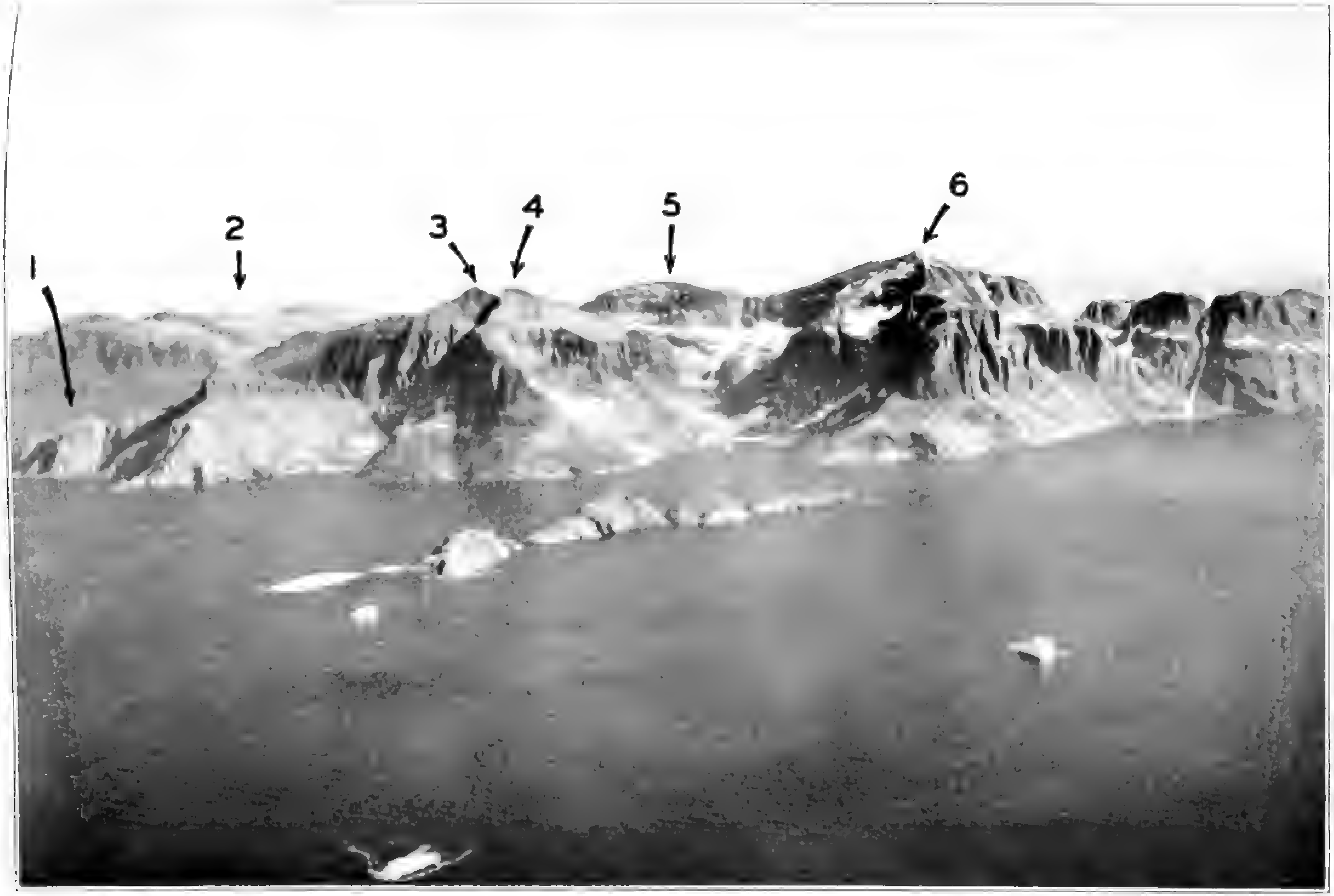
Seidenfaden[1] in a study of the plants characteristic of moving soils in East Greenland found that the plants "very seldom have time and power to flower." This was not the case with plants growing on the margins of soil polygons in northeastern Labrador. In his discussion he does not distinguish clearly between areas where vertical movement of the soil predominates, as in the case of soil polygons, and areas where a horizontal motion of the soil is combined with a vertical component as the result of solifluction on slopes. It is difficult, therefore, to compare his observations on the flora of soil polygons in East Greenland with my own in Labrador, but it would appear that in East Greenland a larger number of species occur in such habitats. The general problem of plants in relation to moving soils is a phase of arctic and alpine ecology which is deserving of more attention than it has yet received.

Indicative of the major significance of water in the success of plants at higher altitudes was the presence on a narrow, barren, dry ridge leading toward the higher slopes of the Bishop's Mitre (see Pl. 411) of an exceptional and restricted, moist, mossy area not more than three feet across, with the following species covering it: *Poa glauca*, *Oxyria digyna*, *Cerastium alpinum* var. *glanduliferum*, *Ranunculus pygmaeus*, *Saxifraga rivularis*. There were numerous stunted individuals of each species closely crowded together, forming a very small segment of meadow-like appearance. It was strikingly different from the occasional widely scattered individuals composing the flora elsewhere at the higher levels and especially for this particular ridge which was otherwise as bare as a city pavement.

d. Flora of higher Elevations and Comparison with contemporary Greenland Nunataks

The results of the major object of the collecting, namely that from higher elevations, is summarized in Tables I, II, and III, the first listing plants found directly on the tops of the mountains; the second,

[1] Seidenfaden, G. Moving Soil and Vegetation in East Greenland. Meddel. Grøn., lxxxvii, no. 2, 1–21 (1931).



Aerial View of The Bishop's Mitre, Kaumajet Mountains, from the North, 1931 (*courtesy of* Professor Alexander Forbes and The American Geographical Society). Fig. 1, Mugford Tickle; fig. 2, Ogualik Island; fig. 3, East Peak of The Bishop's Mitre; fig. 4, West Peak of The Bishop's Mitre; fig. 5, Odell's Peak, southwest of the Bishop's Mitre; fig. 6, Brave Mountain those growing on the higher slopes of the mountains and on the tops of the higher ridges; and the third, those of the moist slopes, gullies, or on scree (talus). Included under the heading Arctic America are stations on James Bay and the southwest coast of Hudson Bay which, strictly speaking, are not arctic.

The fact which immediately stands out is the absence of vascular plants from the tops of the two highest mountains investigated, Mt. Tetragona and "X" peak, both in the Torngats. Both of these mountains, however, have a number of lichens and some mosses growing on their tops. The balance of the mountain summits have a decidedly limited flora, the number of individual species depending partly on altitude, partly on latitude, and partly on proximity to the coast. In general the species observed fall into two groups. The first group is composed of plants of a wide arctic distribution, which extend south at least into the Gulf of St. Lawrence region. The second group consists of those arctic species which reach their southernmost limit in Labrador. The members of a very small third group are not known from western America, namely *Cassiope hypnoides*, which is otherwise of wide arctic dispersal (including arctic Eurasia) and occurs in eastern America as far south as alpine habitats of the New England mountains, and *Antennaria angustata*, which appears to be restricted to eastern arctic and subarctic America. In general, then, these plants are of wide arctic distribution. Altitudinally they are not restricted to the mountain tops, but as a consultation of the second part of this paper will show, they occur freely also at the lower levels. It is evident that it is only the hardier members of the flora which are able to survive the severe environment of the higher mountain tops which form isolated portions of the old northeastern Labrador peneplain.

On the higher mountain slopes and tops of ridges (Table II), a larger number of species exists. Many of these, as might be expected, are the same as occur on the tops of the higher mountains. The greater number of species fall into the same categories as those indicated for Table I. In addition there is a small group not known from the northern coast of the American continent west of the Melville Peninsula. These are *Cassiope hypnoides*, *Antennaria angustata* and *A. hudsonica*. Practically all the species which occur at the higher elevations in the Torngat and Kaumajet Mountains are therefore either ubiquitous arctic forms or at least occur in the Arctic of eastern America.

TABLE I

PLANTS COLLECTED ON MOUNTAIN TOPS IN NORTHEASTERN LABRADOR

Occurrence in northern part of western hemisphere[1]						Torngat Region						Kaumajet Region		
Rocky Mountains and (or) Alaska	Arctic America (incl. Hudson Bay)	Arctic Archipelago	Greenland	Gulf of St. Lawrence Region		Ikordlearsuk Mt.—1st Summit	Ikordlearsuk Mt.—2nd Summit	Mt. Tetragona	"K-2" Mountain	Precipice Mountain	"X" Peak	Bishop's Mitre—East Summit	Bishop's Mitre—West Summit	Odell's Peak west of Bishop's Mitre
					Altitude in feet→	2250[2]	2800	4420	2466	3670	4575	3750	3700	3620
X	X	X	X	X	Lycopodium Selago var. appressum				X					
X	X	X	X	X	Hierochloë alpina				X					
X	X	X	X	X	Poa glauca		X			X				X
X	X	X	X	O	P. arctica				X			X		
X	X	X	X	X	Festuca brachyphylla				X					
X	X	X	X	X	Carex scirpoidea				X					
X	X	X	X	X	Luzula confusa	X	X		X	X		X	X	X
X	X	X	X	X	L. spicata				X					
X	X	X	X	O	Papaver radicatum		X						X	
X	X	X	X	X	Cardamine bellidifolia	X				X		X	X	
X	X	X	X	O	Draba fladnizensis var. heterotricha								X	
X	X	X	X	X	Saxifraga rivularis					X			X	
X	X	X	X	X	S. cernua								X	
X	X	X	X	O	Cassiope tetragona				X					
O	O	X	X	X	C. hypnoides				X					
X	X	X	X	X	Vaccinium Vitis-Idaea var. minus				X					
O	O	X	X	O	Antennaria angustata				X					
					Mosses and lichens only			X			X			

[1] For foot-notes 1 and 2 see p. 117.

The only other detailed record of the plants which occur at higher elevations is that of Delabarre. He notes the species[3] which he collected on Mt. Faunce (north of Nachvak) between 3500 feet and the top, 4400 feet, as the following: "Papaver nudicaule," "Draba fladnitzensis," "Cerastium alpinum," "Luzula confusa," "Saxifraga caespitosa," "S. rivularis," "S. nivalis," and "Sedum?". This record of a *Sedum* is questionable, and it is probable that something else was mistaken for it. Otherwise the species reported are in close agreement with these which I collected on other mountains of the region. Delabarre's description[4] of his collecting on Mt. Faunce is so felicitous that I quote portions of it, "The height here was 3,400 feet . . . Thence we went up a series of not very difficult slopes along an exceedingly narrow ridge . . . The surface was of finely broken stone. A very little scattered vegetation grew on it, and this was almost exclusively moss and lichen, with occasional individual small plants of grass and very rarely a small flowering plant. Of the latter I found not more than half a dozen varieties." And in a subse-

Foot-notes 1 and 2 from TABLE I:

[1] Errors of omission and commission are difficult to avoid in compiling a table of distribution such as this and the corresponding ones for Tables II and III. In preparing these tables the collections of the Gray Herbarium, taxonomic revisions of certain groups, and the following general works have been utilized:—

Fernald, M. L. Persistence of Plants in Unglaciated Areas of Boreal America. Mem. Gray Herb. of Harvard Univ. II. (1925), repr. from Mem. Amer. Acad. Arts and Sci., xv. 239–342 (1925); also numerous taxonomic revisions and phytogeographical papers appearing in RHODORA by the same author.

Holm, Theo. Contributions to the Morphology, Synonymy and Geographical Distribution of Arctic Plants. Report of the Can. Arct. Exp., 1913–18. v. pt. B. (1922).

Lewis, H. F. An annotated List of Vascular Plants collected on the North Shore of the Gulf of St. Lawrence. Can. Nat. xlv. 129–135, 174–179, 199–204, 225–228; xlvi. 12–18, 36–40, 64–66, 89–95 (1931 and 1932).

Ostenfeld, C. H. The Flora of Greenland and its Origin. Kgl. Danske Vidensk. Selsk., Biol. Medd. vi, no. 3 (1926).

Raup, H. M. Phytogeographic Studies in the Peace and Upper Liard River Regions, Canada. Contr. Arnold Arb. Harvard Univ. no. VI, 1–230 (1934).

Simmons, H. G. Vascular Plants of Ellesmereland. Second Arct. Exp. "Fram," 1898–1902, no. 2 (1906); and also his Phytogeography of the Arctic American Archipelago. Lunds Univ. Arsskr. N. F. pt. 2, ix, no. 19 (1913).

[2] Barometrically determined altitude. The other altitudes are based on the survey conducted in the course of the season of 1931 by Mr. O. M. Miller of the American Geographical Society, and were kindly furnished by him.

[3] In the list of plants which he gives in his Report of the Brown-Harvard Expedition to Nachvak, Labrador 1900, Bull. Geogr. Soc. Phila., iii. 177 et seq. (1902), the nomenclature of the species from Mt. Faunce is not very sure. However in his chapter on the plants of Labrador in Grenfell, W. T., Labrador, New York (1913), page 412, he seems to understand the species somewhat more clearly, and it is primarily from the latter that the species are quoted.

[4] l. c.

TABLE II

PLANTS COLLECTED ON MOUNTAIN SLOPES AND ON THE TOPS OF RIDGES IN NORTHEASTERN LABRADOR

Occurrence in northern part of western hemisphere[1]						Torngat Region							Kaumajet Region			
Rocky Mountains and (or) Alaska	Arctic America incl. Hudson Bay	Arctic Archipelago	Greenland	Gulf of St. Lawrence Region		Ridge S. of East Bay, Ikordlearsuk	Tetragona, spur on S. W. side	"K-2"—near the summit	"K-2"—lower slopes	Precipice Mt.—N. E. shoulder	Precipice Ridge	Razorback Harbor, ridge on N. side	Bishop's Mitre—upper slopes	Bishop's Mitre—ridge leading to upper slopes	Mugford peninsula—upper ridge	Mugford peninsula—lower ridge
					Approximate altitude in feet→	1720	3500	2000	1500	3000	1910	2000	3500	2750	2500	1800
X	X	X	X	X	Lycopodium Selago var. appressum	X										
X	X	X	X	X	Hierochloë alpina	X					X	X				
X	X	X	X	O	Phippsia algida				X							
X	X	(X)[2]	X	X	Trisetum spicatum var. Maidenii									X		
X	X	X	X	X	Poa alpina								X			
X	X	X	X	X	P. glauca		X					X		X		
X	X	X	X	X	Festuca brachyphylla							X				
X	X	X	X	X	Carex capillaris			X								
X	X	X	X	O	C. misandra								X			X
X	X	X	X	X	C. concolor	X					X	X				
X	X	X	X	X	Luzula confusa	X					X	X			X	
X	X	X	X	X	L. spicata							X				
X	X	O	O	X	Salix vestita								X			
O	X	X	X	X	S. Uva-ursi						X				X	
O	X	X	X	X	S. herbacea										X	

Table II—*Continued*

Plants collected on Mountain Slopes and on the Tops of Ridges in Northeastern Labrador

Occurrence in northern part of western hemisphere[1]						Torngat Region							Kaumajet Region			
Rocky Mountains and (or) Alaska	Arctic America incl. Hudson Bay	Arctic Archipelago	Greenland	Gulf of St. Lawrence Region		Ridge S. of East Bay, Ikordlearsuk	Tetragona, spur on S. W. side	"K-2"—near the summit	"K-2", lower slopes	Precipice Mt.—N. E. shoulder	Precipice Ridge	Razorback Harbor, ridge on N. side	Bishop's Mitre—upper slopes	Bishop's Mitre—ridge leading to upper slopes	Mugford peninsula—upper ridge	Mugford peninsula—lower ridge
					Approximate altitude in feet→	1720	3500	2000	1500	3000	1910	2000	3500	2750	2500	1800
X	X	X	X	(X)	Salix anglorum								X			
X	X	X	X	X	Oxyria digyna									X		
X	X	X	X	X	Silene acaulis var. exscapa			X								
X	X	X	X	O	Lychnis furcata			X								
O	X	X	X	X	Cerastium alpinum var. glanduliferum							X		X		
O	X	O	X	X	C. alpinum var. lanatum					X						
X	X	X	X	X	Arenaria verna var. pubescens								X			
X	X	X	X	X	Arenaria sajanensis							X	X		X	X
O	X	X	X	X	Sagina nivalis										X	
X	X	X	X	X	Ranunculus pygmaeus	X	X							X		
X	X	X	X	O	Papaver radicatum				X						X	X
X	X	X	X	X	Cardamine bellidifolia				X			X			X	
X	X	X	X	O	Draba fladnizensis var. heterotricha		X		X			X	X			
O	O	O	X	X	D. rupestris		X						X		X	
X	X	X	X	X	D. nivalis		X								X	
X	X	X	X	O	Arabis arenicola		X		X				X			

TABLE II—*Continued*

PLANTS COLLECTED ON MOUNTAIN SLOPES AND ON THE TOPS OF RIDGES IN NORTHEASTERN LABRADOR

Occurrence in northern part of western hemisphere[1]						Torngat Region							Kaumajet Region			
Rocky Mountains and (or) Alaska	Arctic America incl. Hudson Bay	Arctic Archipelago	Greenland	Gulf of St. Lawrence Region		Ridge S. of East Bay, Ikordlearsuk	Tetragona, spur on S. W. side	"K-2"- near the summit	"K-2"—lower slopes	Precipice Mt.—N. E. shoulder	Precipice Ridge	Razorback Harbor, ridge on N. side	Bishop's Mitre—upper slopes	Bishop's Mitre—ridge leading to upper slopes	Mugford peninsula—upper ridge	Mugford peninsula—lower ridge
					Approximate altitude in feet→	1720	3500	2000	1500	3000	1910	2000	3500	2750	2500	1800
X	X	X	X	X	Saxifraga rivularis									X		X
X	X	X	X	X	S. cernua								X			
X	X	X	X	X	S. cespitosa	X	X							X		
X	X	X	X	O	S. nivalis		X									
X	X	X	X	X	S. oppositifolia			X					X			
X	X	X	X	X	Dryas integrifolia											X
O	O	X	X	X	Cassiope hypnoides											X
X	X	X	X	X	Vaccinum Vitis-Idaea var. minus						X					
(X)	X	X	X	X	Campanula rotundifolia							X				
X	X	X	X	O	Erigeron unalaschkensis								X			
O	X	X	O	O	Antennaria hudsonica	X										
O	X	X	X	O	A. labradorica (?)					X						
O	O	X	X	O	A. angustata		X					X				
X	X	X	X	X	Taraxacum lacerum							X				
X	X	X	O	X	Crepis nana											X

[1] See corresponding footnote to Table I.

[2] Parentheses indicate that the species *in sensu lato* is known from the region represented by the column.

quent paragraph he says: "The material of the mountain is the same as that of which most of Labrador is formed: mainly hornblende gneiss, cut here and there by dykes of darker trap. The summit is of almost knife-like sharpness and very jagged." (This is often the case but not universal in the Torngat Mountains.) "It is nearly level for about a hundred yards . . . and goes down by a series of steps to the valley." The level top referred to is doubtless a portion of the old peneplain.

The vegetation of the present-day nunataks and mountains of Greenland presents a significant yard-stick for the appraisal of the plants growing at higher levels in northeastern Labrador. Before considering the flora of nunataks it is well to have in mind a clear idea of what is meant by the term nunatak. Among geologists it is considered to be a hill or mountain surrounded by an ice-sheet. This necessitates that it be of relatively restricted area; that it be *above* the ice and thus exposed to the winds and storms sweeping across the ice-fields; and being *above* the ice, that the available water supply be very slight since all melt-water from the ice below is unavailable to it; inherent in its nature as a hill or a mountain top, it would have excellent drainage. All these factors combine to provide an area which ecologically is unfavorable for any but the hardiest plants, because of the sterile and well-drained nature of the soil, and because such a locality partakes of the rigorous climate of the ice-cap.

In Greenland, Böcher[1] mentions as the only plant which he found on a nunatak at Kangerdlugssuak (East Greenland, lat. about 68° N.) *Papaver radicatum.* At Cape Deichman (East Greenland, lat. about 68° N.) he found the following plants on a nunatak, "*Salix arctophila* × *glauca, S. herbacea, Empetrum, Vaccinium, Oxyria, Polygonum, Cerastium alpinum, Silene acaulis, Ranunculus glacialis, Saxifraga oppositifolia, Poa glauca,* and *Luzula confusa.*"

Devold and Scholander[2] note the following species on a rocky plateau, The Brandalfjaell, at Kangerdlugssuak (altitude of about 3476 feet): *Luzula confusa, Papaver radicatum, Silene acaulis, Saxifraga rivularis,* and *Poa glauca;* with the following, in addition, at the margin of the plateau: *Hierochloë, Poa arctica, Luzula spicata, Potentilla emarginata, Phippsia algida,* and *Empetrum.* On Møretind (alt.

[1] Böcher, T. W. Studies on the Vegetation of the East Coast of Greenland between Scoresby Sound and Angmagssalik. Medd. Grønl. civ, no. 4 (1933).

[2] Devold, J. and Scholander, P. F. Flowering Plants and Ferns of Southeast Greenland. Skrifter on Svalbard og Ishavet, no. 56 (1933).

about 3936 ft., lat. about 60° 30′ N., in Southeast Greenland) they found *Lycopodium Selago, Cardamine bellidifolia, Silene acaulis, Salix herbacea, Cassiope hypnoides, Antennaria "alpina," Juncus trifidus, Luzula confusa, Luzula spicata, Carex concolor* (*C. rigida*), *Agrostis borealis.* The authors note that these are all (except *Cardamine bellidifolia* and *Luzula confusa*) species of lower elevations in that part of Greenland, a striking parallel to conditions in northeastern Labrador, where, however, even *Cardamine bellidifolia* and *Luzula confusa* are present in the lowlands.

Ostenfeld[1] considers that of the eight species on Midgaardsorm, a nunatak at about 81° N. near the north coast of Greenland, 3 are high-arctic and the other 5 are arctic species. He describes three other nunataks in southern West Greenland (lat. about 63° N.), each with 26 or 27 species and a total flora of 54[2] species. Of these 54 species, 40 are arctic, 3 high-arctic, and only 11 subarctic and boreal. He characterizes the plants occurring on nunataks in Greenland as the hardiest part of the Greenland flora. These widely distributed "glacial species" he thinks are those most likely to have lived through the period of maximum glaciations in Greenland.

Simmons[3] (p. 142) says "the present flora of nunataks and other areas of habitable ground hardly speaks in favour of looking on the main of the Greenland flora as preserved in that way" (namely on nunataks). He goes on to say ". . . we will have to look for such possible survivors only among the high arctic and most hardy species, but these again are generally circumpolar and thus are not apt to give any evidence for or against the hypothesis of persistence." Similarly the species on the mountains of northeastern Labrador are of general arctic or subarctic occurrence. As a result they do not provide positive evidence concerning the glacial history of the mountains. If the upper slopes and tops of the mountains were ice-covered during the Wisconsin, it is these hardy, "aggressive" species which would be expected to follow the retreating ice to the summits of the mountains. On the other hand, if these mountain tops existed as nunataks during the Wisconsin, it is again these "glacial species," as

[1] Ostenfeld, C. H. The Flora of Greenland and its Origin. Kgl. Danske Vidensk. Selskab., Biol. Medd. vi, no. 3 (1926).

[2] For an idea of the flora of such nunataks in East Greenland see the list of plants collected by Bjørlykke on Nordenskiolds Nunatak, in Devold and Scholander, l. c. p. 172.

[3] Simmons, H. G. Phytogeography of the Arctic American Archipelago. Lunds Univ. Arsskr. N. F. pt. 2, ix, no. 19 (1913).

Ostenfeld calls them, which would persist the longest under such adverse environmental conditions. Thus the plants of the higher elevations are of such a character that they contribute no positive evidence toward the solution of the problem of whether the Wisconsin ice completely inundated the mountains. But there still remains the fact that plants of cordilleran affinities occur elsewhere in Labrador.

In Table III are listed species which occur on moist slopes, in gullies, and on scree-slopes in northern Labrador. Here again the great majority of the species represented in Tables I and II are present. There are also some species in addition, primarily those requiring moister habitats. Also it should be noted that most of the habitats treated in this table are at relatively low elevations. Of the species mentioned in Table III, only *Cerastium Beeringianum* stands out as having a disrupted range, in the strictest sense of the term. Another example of this type of distribution is *Arenaria humifusa* (*A. cylindrocarpa*), which was collected during the summer of 1931, but is not listed in Table III because it was found practically at sea-level.

This brings us to a consideration of species characterized by disrupted ranges. Notable for this among all other species of the northeastern Labrador flora is *Carex filifolia* Nutt. which was collected in 1900 at Nachvak by Delabarre.[1] This western plant is as yet unknown elsewhere than at this station in eastern North America. It also seems to be the only species yet known from Labrador with this type of distribution. This statement requires some explanation since Professor Fernald (p. 316)[2] gives a somewhat longer list of such plants. In the ten years which have passed since the publication of his memoir, changes in taxonomic concepts and further exploration have modified our knowledge of the species which he mentions in this category. His *Draba stenoloba* is now interpreted[3] as *D. Sornborgeri* Fernald a new species endemic in Labrador. *Pedicularis groenlandica* Retz. is now known not only from northeastern Labrador and the Rocky Mountains, but also from James Bay and Port Harrison on Hudson Bay, Saskatchewan and the Athabaska drainage. *Petasites sagittata* (Pursh) Gray has been collected at James Bay and Fort Albany on Hudson Bay, and also occurs in Minnesota, Manitoba,

[1] l. c.

[2] Fernald, M. L. Persistence of Plants in Unglaciated Areas of Boreal America. Mem. Gray Herb. Harvard Univ. II (1925).

[3] Fernald, M. L. Draba in temperate northeastern America. Rhodora xxxvi. 319–321 (1934).

Table III

Plants collected on Moist Slopes, in Gullies, and on Scree-slopes in Northeastern Labrador

Rocky Mountains and (or) Alaska	Arctic America incl. Hudson Bay	Arctic Archipelago	Greenland	Gulf of St. Lawrence Region		N. side of ridge on S. side of East Bay, Ikordlearsuk	Scree on S. side of Peak 19, The Four Peaks	Old scree, Valley of Bryant Lakes	Scree slide from Precipice Ridge	Moist gully in cliff, N. side of Razorback Harbor	Gully from Valley of Twin Falls to lower ridge, Mugford, Peninsula
					Approximate altitude in feet→	1400	2750	200	1300	1900	1400
X	X	X	X	X	Woodsia ilvensis			X		X	X
X	X	X	X	X	W. glabella						X
X	X	X	X	X	Cystopteris fragilis			X			X
X	X	X	X	X	Agrostis borealis				X		
X	X	(X)[1]	X	X	Trisetum spicatum var. Maidenii					X	
(X)	(X)	(X)	(X)	X	T. spicatum var. pilosiglume				X		
X	X	X	X	X	Poa glauca				X		
X	X	O	X	X	P. alpigena				X		
X	X	X	X	X	Festuca brachyphylla				X		
X	X	X	X	X	Carex bipartita		X				
X	X	X	X	X	C. scirpoidea					X	
X	X	X	X	X	Luzula spicata				X		
X	O	O	X	X	L. campestris var. frigida					X	
X	X	X	X	X	Tofieldia minima						X
X	(X)	(X)	(X)	X	Salix anglorum var. araioclada		X				
X	X	X	X	X	Oxyria digyna						X
X	X	X	X	O	Lychnis furcata	X		X			
O	O	O	X	X	L. alpina					X	
X	O	O	O	X	Cerastium Beeringianum					X	
O	O	O	X	X	Cerastium cerastioides				X	X	
X	X	X	X	X	Arenaria verna var. pubescens		X				
X	X	X	X	X	A. sajanensis	X					
O	X	X	X	O	Ranunculus nivalis	X					

[1] Parentheses indicate that the species *in sensu lato* is known from the region represented by the column

Table III—*Continued*

Plants collected on Moist Slopes, in Gullies, and on Scree-slopes in Northeastern Labrador

Rocky Mountains and (or) Alaska	Arctic America incl. Hudson Bay	Arctic Archipelago	Greenland	Gulf of St. Lawrence Region		N. side of ridge on S. side of East Bay, Ikordlearsuk	Scree on S. side of Peak 19, The Four Peaks	Old scree, Valley of Bryant Lakes	Scree slide from Precipice Ridge	Moist gully in cliff, N. side of Razorback Harbor	Gully from Valley of Twin Falls to lower ridge, Mugford, Peninsula
					Approximate altitude in feet→	1400	2750	200	1300	1900	1400
X	X	X	X	X	Cardamine bellidifolia	X	X				
X	X	X	X	O	Draba fladnizensis var. heterotricha	X			X		
X	X	X	X	X	D. nivalis			X			
X	X	X	X	O	Arabis arenicola						X
O	X	X	X	X	A. alpina						X
X	X	X	X	X	Saxifraga rivularis	X					
X	X	X	X	X	S. cernua		X				X
X	X	X	X	X	S. cespitosa						X
X	X	X	X	X	S. stellaris var. comosa	X					
X	X	X	X	O	S. nivalis	X	X				
X	X	X	X	X	S. aizoides					X	
X	X	X	X	O	S. tricuspidata					X	
X	X	X	X	X	S. oppositifolia						X
X	X	O	X	X	Parnassia Kotzebuei						X
X	X	X	X	X	Potentilla nivea						X
X	X	X	X	X	P. emarginata	X					
X	X	O	O	X	Solidago multiradiata					X	
O	O	X	O	O	Antennaria canescens					X	
O	O	X	X	O	A. angustata		X		X		
O	X	O	X	X	Gnaphalium supinum		X		X		
O	X	O	O	X	Arnica terrae-novae					X	
X	X	X	X	X	Taraxacum lacerum					X	
X	O	X	X	X	T. lapponicum					X	

Saskatchewan, and the Rocky Mountains. *Crepis nana* Richards. has since been collected in Newfoundland and is also known from the Arctic Archipelago and the Arctic Coast, as well as from the Rocky Mountains.

Thus *Pedicularis groenlandica* and *Petasites sagittata* fall in line with other species from Labrador which have "way stations" between their far eastern and far western localities somewhere in the central portion of the continent. Other examples of such Labrador plants (which also occur in the Gulf of St. Lawrence region) are *Danthonia intermedia* Vasey, *Aster foliaceus* Lindl., var. *frondeus* Gray, and *Solidago multiradiata* Ait.

On the basis of our present knowledge of their distribution, *Crepis nana* and *Taraxacum lacerum* occupy "way stations" along the northern coastal fringe of the continent. As further facts concerning the flora of the central portion of subarctic America become available, we may well expect these two apparently different routes to merge into one.

In view of the poorly explored nature of much of the region, both continental and coastal, between the Torngat Mountains of northeastern Labrador and the foothills of the Rockies, occasional records from this intervening area, such as for the species mentioned in the preceding paragraphs, assume more than usual significance. Thus, in the strictest sense of the term, the species mentioned above may not be considered to have disrupted ranges. However, this does not alter the fact that plants with such ranges exist in northeastern Labrador, notably *Carex filifolia*. Other cordilleran species with a somewhat wider distribution in eastern America in addition to their occurrence in northeastern Labrador are *Cerastium Beeringianum* Cham. & Schl., *Senecio pauciflorus*[1] Pursh, *Epilobium Drummondii* Hausskn. and *Arenaria humifusa* Wahlenb.

There is also a small number of endemics in northeastern Labrador (some of them occurring elsewhere in Labrador as well), including *Arnica Sornborgeri* Fernald, *Antennaria pygmaea* Fernald, *A. Sornborgeri* Fernald, *A. burwellensis* Malte, *A. congesta* Malte, *Taraxacum torngatense* Fernald, *Draba Sornborgeri* Fernald and *Poa labradorica* Steudel. These occur in notably "difficult" genera, whose plasticity is well known. Especially in *Arnica, Antennaria* and *Taraxacum,* which tend to set seed apogamously, any mutant forms fitted to their

[1] With an intermediate station at Fort Franklin, Mackenzie River.

environment might be expected to be perpetuated more readily than in plants setting seed in the usual fashion. These genera might well be considered to be among the first to "throw" recognizable new species. It is of interest, however, as Fernald says (l. c. p. 317), that these are "species with their affinities clearly with cordilleran plants." To what extent this similarity can be attributed to parallel mutations is a question of interest which needs further study for its solution.

E. Contemporary Climate and Relic Species

In considering the presence of unusual species in the flora of northeastern Labrador it is natural to look to the climate as a possible explanation. Coleman (l. c. page 9) gives a good description of some of the features of the climate of northeastern Labrador. As he points out, the climate is "more nearly arctic than its latitude." Hann[1] characterizes its climate as decidedly sub-arctic and on the north coast as arctic, as does Koeppe.[2]

A climatic factor which would appear to be of primary importance in plant distribution is temperature. Charts[3] illustrating temperature conditions are provided in FIGS. 2–5. It will be noted that the sea-level isotherms representing the winter mean temperatures of northern Labrador approximate those of northwestern Greenland and James Bay (FIG. 2); that the early spring mean temperatures are comparable to those in central West Greenland and the central portion of Hudson Bay (FIG. 3); that the summer mean temperatures are similar to those in southwestern Greenland and northern Hudson Bay (FIG. 4); and that the fall mean temperatures are essentially similar to the summer mean temperatures (FIG. 5). Perhaps the most significant of these charts from the botanical point of view is that for July (FIG. 4), because it gives us a picture of temperature conditions at the height of the growing season. But this does not provide a clear-cut explanation for the presence of unusual elements in the flora, since many

[1] Hann, J. Handbuch der Klimatologie, iii. ed. 3. Stuttgart (1911).

[2] Koeppe, C. E. The Canadian Climate. Bloomington, Ill. (1931).

[3] The charts comprising FIGS. 2–7 are traced from manuscript charts recently prepared by Prof. C. F. Brooks, Mr. A. J. Connor, and Dr. W. Köppen. They are very kindly made available at the Blue Hill Observatory of Harvard University before their ultimate publication in Köppen, W. and Geiger, R. Handbuch der Klimatologie, ii, Part J, Klimakunde von Nordamerika by R. DeC. Ward, C. F. Brooks, and A. J. Connor, publ. by Gebr. Borntraeger, Berlin, Germany. The charts were made on Goode's Base Map no. 202 (North America on Lambert's Azimuthal Projection). Used by permission of The University of Chicago Press.

It is pleasure to acknowledge here my indebtedness to Professor Brooks, not only for providing aid in locating climatic data, but also for his constructive suggestions.

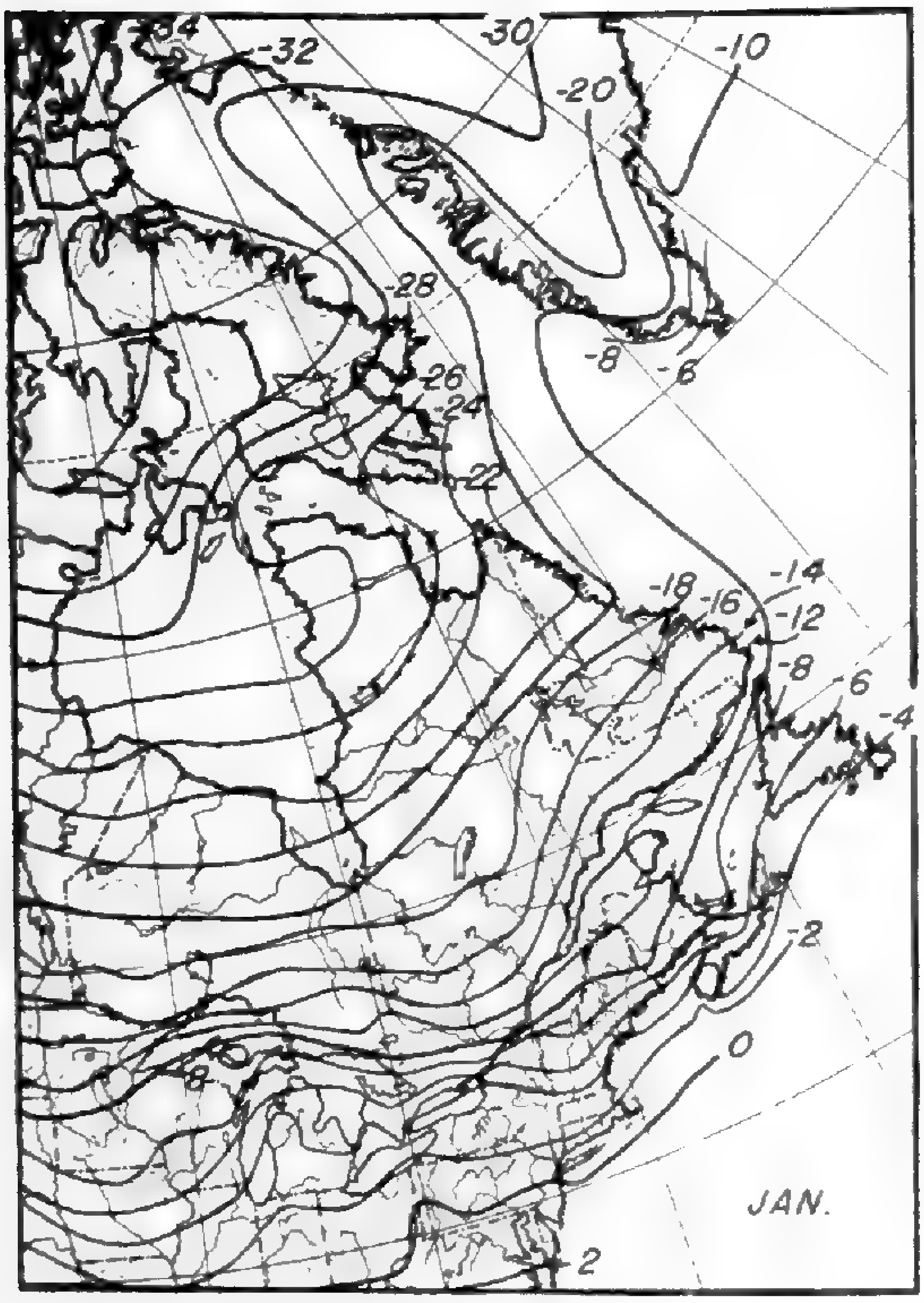


fig. 2.

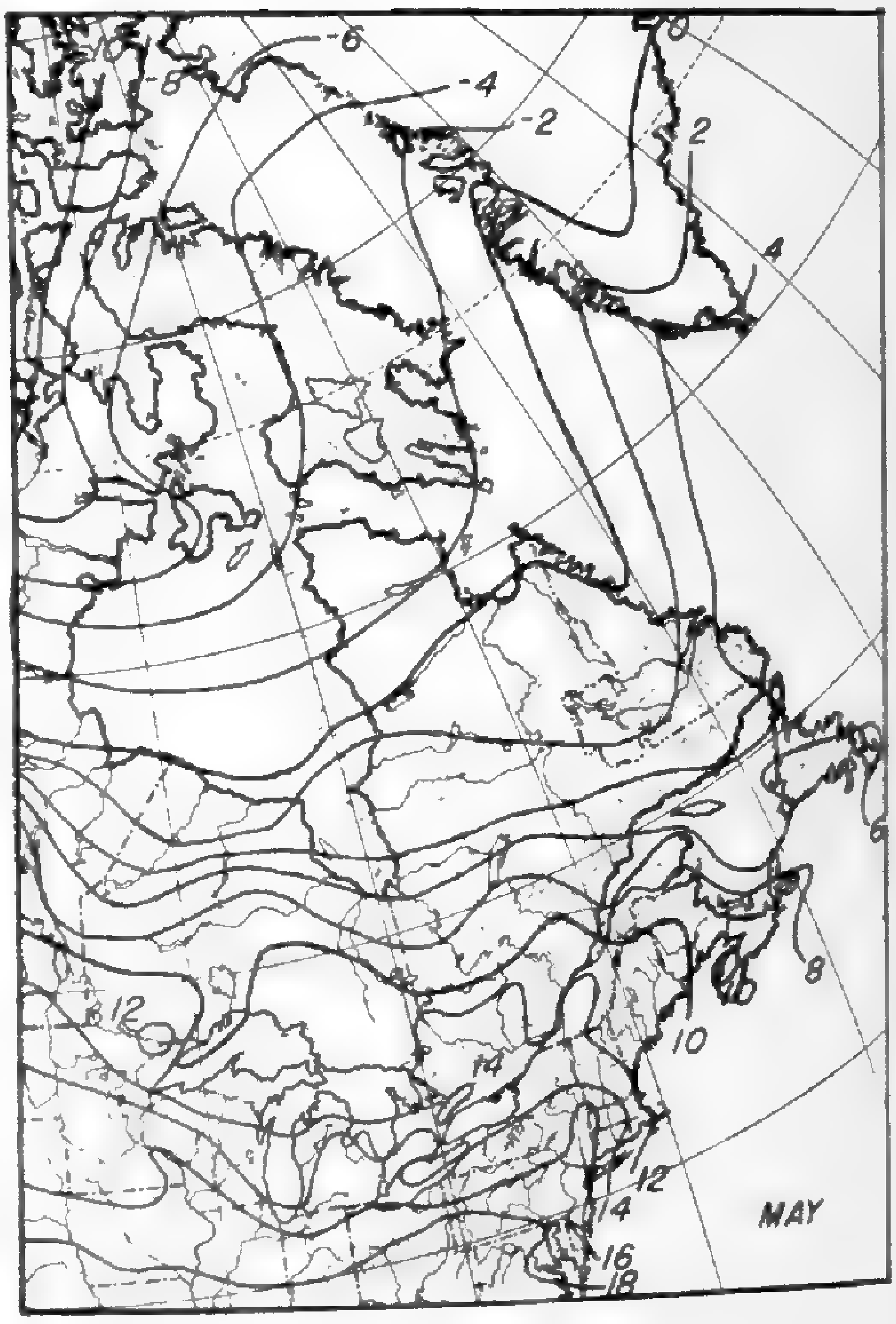


fig. 3.

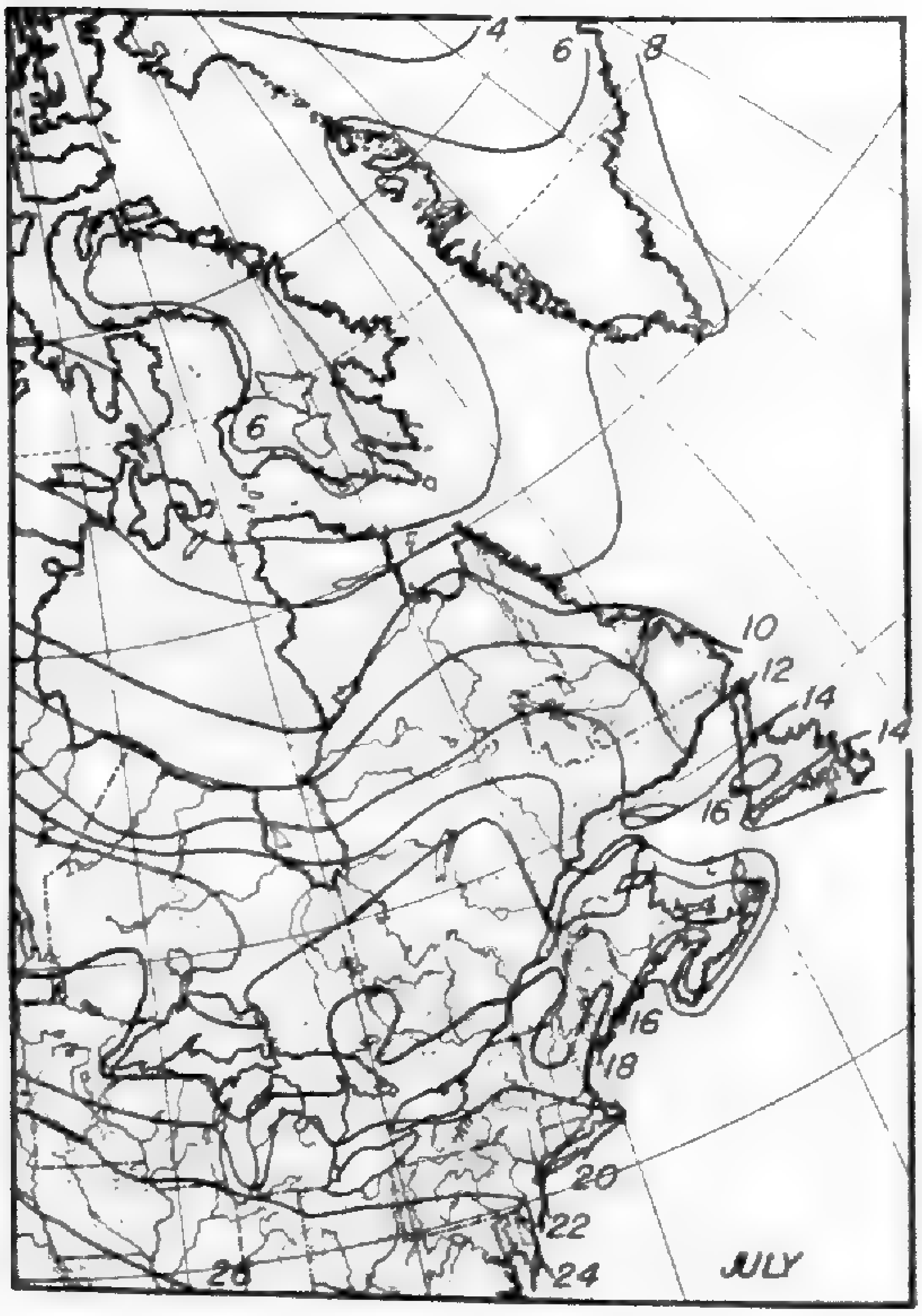


fig. 4.

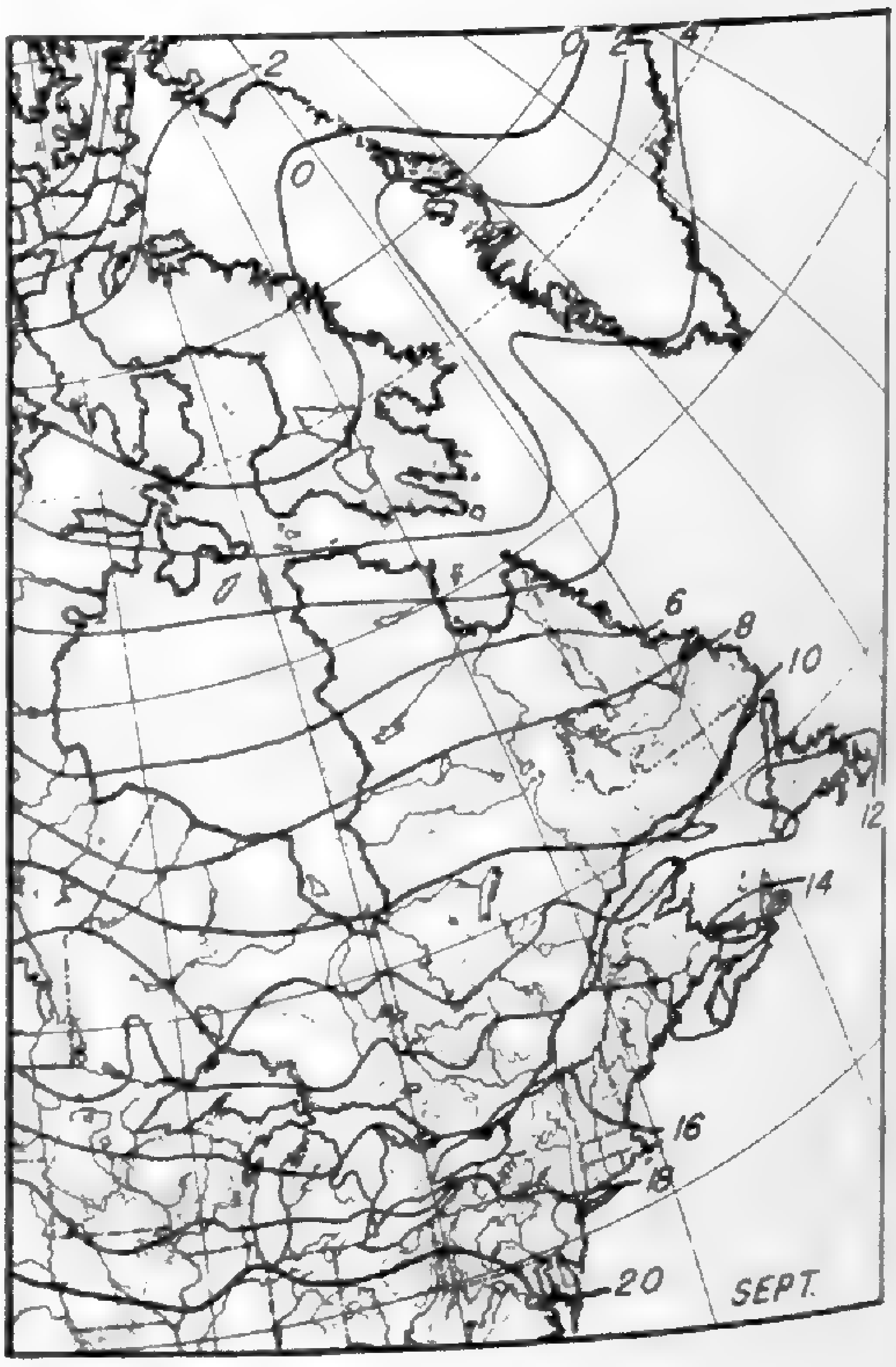


fig. 5.

SEA LEVEL ISOTHERMS IN °C.

For Sources see Footnote, p. 127.

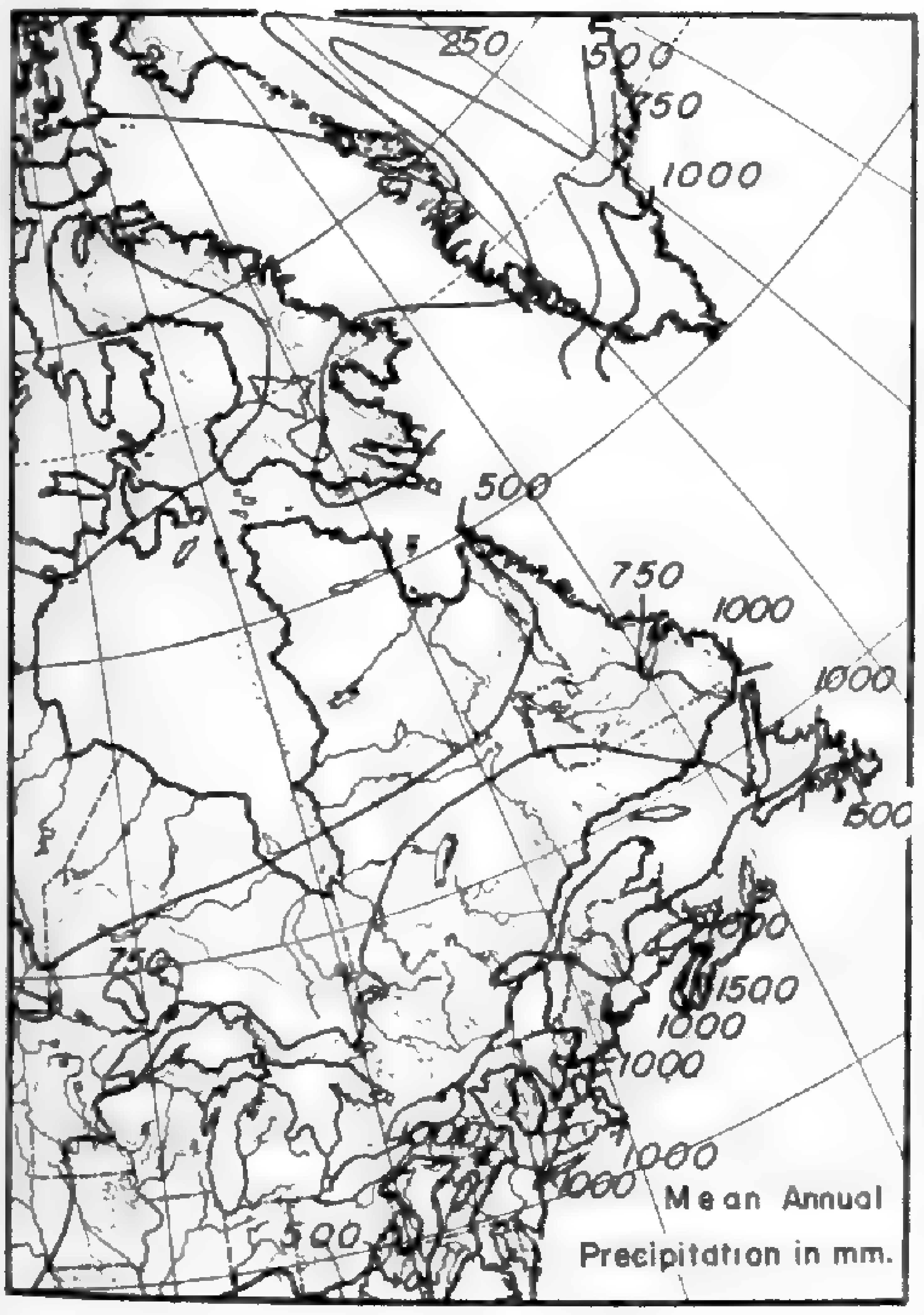


fig. 6.

fig. 7.

For Sources see Footnote, p. 127.

species have a wide tolerance for temperature extremes. This is shown, for instance, in maps illustrating the distribution of *Saxifraga oppositifolia*,[1] *Androsace septentrionalis*,[2] and *Scirpus cespitosus* var. *callosus*.[3] The ranges of these species cross the isotherms in a way which indicates that certainly not all boreal species are controlled by temperature conditions alone in their distribution.

Another factor to be considered is the precipitation. In FIG. 6 the mean annual precipitation in millimeters is shown. Here again will be noted a general similarity between northern Labrador, southeastern Greenland and James Bay. FIG. 7 shows the amount of rainfall at the height of the growing season, in July. The amount of precipitation is comparable with that of southern Greenland, eastern Baffinland, the Gulf of St. Lawrence region in part, the north shore of Lake Superior, and James Bay. Like temperature, precipitation alone does not solve the problem, especially since an extra variable, the soil moisture derived from the melting snow, supplements atmospheric precipitation. On a preceding page it was pointed out that the sparse

[1] Map 1 in Fernald, M. L. Recent Discoveries in the Newfoundland Flora. Rhodora, xxxv. 7 (1933).

[2] Map 5, Fernald, l. c. 82.

[3] Map 10, Fernald, l. c. 88

and hardy flora of the higher altitudes in northeastern Labrador could probably be attributed primarily to the small amount of available water. At lower elevations the amount of ground water becomes increasingly greater, because of the run-off from melting snow-fields and from the gradual thawing of the subsoil as the summer advances. It is, therefore, difficult to evaluate the flora in terms of atmospheric precipitation alone, especially since so many local factors operate.

Another feature responsible for the character of the climate of Labrador is the winds which are predominantly on-shore from the northerly quarter or else are from the westerly quarter.[1] Sweeping in over the ice-cold[2] Labrador current the northerly and northeasterly winds account for the low summer temperatures of Labrador, especially on the immediate coast and its islands. In combination with the low temperatures, strong on-shore winds are probably a major factor in the limitation of plant life on this immediate coastal strip because of their desiccating qualities. When the winds are offshore during the summer, weather conditions are less unfavorable, and a chinook effect has even been reported[3] which is also said to be associated with desiccation. These chinook winds were not sufficiently marked during the summer of 1931 to have been observed, although their possible occurrence had been anticipated.

To summarize the various climatic factors considered, evidently the winds off the cold Labrador current are largely responsible for the low temperature of the coastal region. Precipitation during the growing season is limited, but in favorable localities melt-water supplements it. The winds as desiccating agents are especially effective in producing conditions unfavorable for plant life. Thus plants with a sufficiently high survival value to exist at all in northeastern Labrador, really flourish only when occurring in places protected from prevailing winds and if well supplied with soil water. Thus the majority of the plants (both individuals and species) are restricted to the lower, moist, protected habitats. As pointed out above for temperature, and as is also true for the other climatic agencies, plants adapt themselves to a relatively wide range of climatic variability. Climate can be expected to become a limiting factor primarily when there is a major swing away from present conditions.

[1] Koeppe, l. c.

[2] Iselin gives the characteristic temperature of the body of the current as $-1°$ to $-1.5°$ C.; see Iselin, C. A Report on the coastal Waters of Labrador. Proc. Amer. Acad. Arts and Sci., lxvi. 21 (1930).

[3] Coleman, l. c.

While the present climate is important in its effect on the general nature of the flora, at least two other factors are probably more important in their bearing on the presence of highly localized species in Labrador. One is the influence of the underlying rocks on soil composition, and the selective effect of this on the survival of plants in favorable areas. There are indications that the basic soils are important in this respect. But this awaits not only a more general analysis of the plants collected in the past but, more especially, comprehensive collections from the Mugford region in eastern Labrador and from other as yet unexplored localities with basic rocks in western Labrador. The other factor, which may be termed the historical one, deals with glacial and post-glacial history and is of especial interest with reference to the presence of relic species which include the following: *Carex filifolia, Cerastium Beeringianum, Senecio pauciflorus, Epilobium Drummondii,* and *Arenaria humifusa.*

F. Possibilities of Survival of Relic Species on Nunataks during the Wisconsin Glaciation

In seeking a historical explanation for the occurrence of these "relic" species in northeastern Labrador several alternatives suggest themselves. First should be considered the possibility of their survival on nunataks during the height of Wisconsin glaciation. The great modern testing grounds for this concept lie in areas which today have continental glaciers, namely the Antarctic continent and Greenland. It has been pointed out on a preceding page that the most recent geological research in the Torngats throws doubt on the existence of nunataks in the high mountains of northeastern Labrador. If, however, the older theories are correct and we had nunataks as possible sanctuaries for plants during the Wisconsin glaciation they could have been either of two types. They might have been like those of the inhospitable Antarctic continent. In that case there would have been no flowering plants surviving on them, because flowering plants are unknown[1] from the explored regions of the Antarctic continent. If, on the other hand, the environmental conditions of the coast of Labrador have been like those of the coast of Greenland today, we can expect a flora to have existed on the Labrador nunataks similar to that now found on the Greenland nunataks. It is not improbable

[1] See Brown, R. N. R. Antarctic and Sub-antarctic Plant Life and some of its Problems *in* Problems of Polar Research. Amer. Geogr. Soc. Spec. Publ. no. 7 (1928).

that the latter may have been the case because of the environmental similarities between the coast of Labrador and the coast of Greenland. Even today the sparse flora of the higher mountains in northern Labrador resembles that of the nunataks of Greenland. But in both cases the plants composing this high-altitude flora are the hardy species of ubiquitous arctic occurrence. The peculiar relic forms are in general characteristically restricted to more sheltered and favorable localities. It does not appear probable that the ice-surrounded, well-drained, and wind-exposed nunataks which may have existed in northern Labrador during the Wisconsin would have been havens for plants which even today do not grow in habitats of this nature. It may be objected that abundant proof has been presented for the survival of flowering plants on nunataks and driftless areas in the Gulf of St. Lawrence region. But it is important to remember in considering this, that the solution applicable in one area is not necessarily applicable in another area different in physiography, latitude, and its geological conditions. The St. Lawrence region was far better situated during the Wisconsin for the survival of plants at higher elevations (as well as at lower levels), because of the larger areas left uncovered by ice, a warmer climate associated with its more southern latitude, and the predominance of basic rock. On the other hand, northern Labrador with its predominantly acid Archean formations, its more northern latitude and correspondingly more stringent climate, and greater (?) covering of ice was hardly as favorable for the persistence of flowering plants. This suggests another solution to the problem. Could these relic species not have survived at or near sea-level?

G. Possibilities of Survival of Relic Species near Sea Level during the Wisconsin

If these relics survived near sea-level during the Wisconsin, any major environmental change should be taken into account. Both geologists[1] and meteorologists[2] paint very similar pictures of the environment on the shores of the North Atlantic during the greatest ad-

[1] Antevs, E. Retreat of the last Ice-sheet in eastern Canada. Can. Dept. Mines, Geol. Surv. Mem. no. 146 (1925).
Bryan, K. and Cady, R. C. The Pleistocene Climate of Bermuda. Amer. Jour. Sci., xxvii. 241–264 (1934).

[2] Brooks, C. E. P. Climate through the Ages. New York (1926).
Simpson, G. C. World Climate during the Quaternary Period. Quart. Jour. Roy. Met. Soc., lx 425 (1934).

vances of the Pleistocene continental glaciers. Very cold surface water with much floating ice from various sources, southward displacement of the Icelandic low pressure area, with corresponding northerly winds resulting in a diversion to the south of the Gulf Stream, are all points of general agreement among the authorities cited. The effects of this combination of factors on the northwestern portion of the Atlantic Basin are interesting to contemplate. Climatic conditions on the coast of northeastern Labrador would have been more severe than they are today, since the waters of the northwestern corner of the Atlantic would not have been modified even as slightly as they are today by that branch of the Gulf Stream which recurves around the southern tip of Greenland. Instead the whole area would have been subject to the temperatures of the cold surface waters. With prevailing northerly winds, ice-bergs and sea-ice would have tended to be held on shore and thus contribute to lower air-temperatures. Even today the effect of the bleak winds from over the cold Labrador current makes itself evident in the impoverished flora of the coastal islands, headlands, and exposed shore of Labrador. On the other hand, occasional southerly storm-winds of higher temperatures, both because of their origin to the south and because of the latent heat of condensation on the glacial ice-surface, might have counteracted in part effects of agencies responsible for lower temperatures, especially in less exposed localities. In addition there probably were occasional winds of the föhn type blowing off the ice-cap which would also aid in ameliorating the climate in more protected areas. Furthermore, if the coastal mountains acted as barriers to a complete inundation of the coast by ice (much as seems to be the case in Greenland today), the interaction of all these factors might well serve to provide restricted and well-protected areas with a climate sufficiently mild for plants to exist.[1] Not only lichens as suggested by Lynge,[2] but even higher plants might have grown under such conditions.[3] Another fact favoring this is that even when the air-tempera-

[1] Dr. C. Iselin of the Woods Hole Oceanographic Institute has pointed out to me that the Labrador reef may well have served to prevent extreme ice accumulation on the shores of northeastern Labrador, and also that a weak current of relatively fresh water originating from the melting of ice in and about Hudson Bay could have extended locally down the coast of Labrador. Both of these factors would have favored local amelioration of climate in northeastern Labrador.

[2] Lynge, B. General Results of recent Norwegian Research Work on Arctic Lichens. Rhodora, xxxvi. 133 (1934).

[3] A very healthy note of skepticism concerning the reconstruction of climatic conditions during past glaciations is sounded by Nannfeldt (Symbol. Bot. Ups. iii. 80 (1935)). Unfortunately, his thought-provoking paper has come to hand too late to consider in the main body of the discussion.

ture seems to be too low for metabolism in plants in the high Arctic, insolation on clear days raises the temperatures of the plants themselves to such a level that it is possible for the plants to carry on their life processes. For example, Wulff[1] found in North Greenland that on the 10th of June when the air-temperature was as low as − 4.2° C., the temperature 2 cm down in a dense, sun-exposed tuft of *Luzula confusa* was 8.0° C.; on another occasion, the 20th of June, when the air-temperature was only 5.0° C., a sun-exposed tuft of *Saxifraga oppositifolia* was 21.1° C. Possibly then, the balance of all factors were such that in areas, as at the heads of fiords, protected from wind, warmed by occasional föhn winds and by the action of direct insolation, and with melt-water available from the ice-fields above, plants may have survived through the peak of Wisconsin glaciation in the lee of the Torngat Mountains in northeastern Labrador. The major question, however, is whether the cordilleran relics mentioned above could have been among these. It is not unlikely that they could, since in North Greenland, which in many respects resembles this reconstruction of Labrador during the "Ice Age," there occur today a number of species[2] whose ranges extend thirty to forty degrees of latitude to the south, as, for instance, *Woodsia glabella* R. Br., *Festuca brachyphylla* Schultes, *Hierochloë alpina* (Lilj.) R. & S., *Eriophorum Scheuchzeri* Hoppe, *Carex incurva* Lightf., *C. glareosa* Wahlenb., *Juncus albescens* (Lange) Fern., *Oxyria digyna* (L.) Hill, *Cerastium alpinum* L., *Silene acaulis* L., var. *exscapa* (All.) DC., *Draba nivalis* Lilj., *Saxifraga oppositifolia* L , *Dryas integrifolia* Vahl, *Epilobium latifolium* L. and *Androsace septentrionalis* L. (For further examples see Fernald, l. c. pp. 120 and 121).

h. Possibilities of a Post-Wisconsin Migration of Relic Species into Northeastern Labrador during the Climatic Optimum

We have, however, to reckon with the theory that Labrador may have been covered entirely with the ice of the Wisconsin glaciation (Odell, l. c.). Under these circumstances a third alternative comes to mind, since it would have been necessary for the entire flora to have

[1] As reported by Ostenfeld, C. H. The Vegetation of the North-Coast of Greenland. Meddel. Grønl., lxiv. no. 5. 223–268 (1923).

[2] For an extensive consideration of the flora of nunatak areas in Greenland see Gelting, P. Studies on the Vascular Plants of East Greenland, etc. Meddel. Grønl., ci., No. 2. 1–337 (1934).

migrated in with the retreat of the ice. There is a growing tendency to accept the idea of rather large climatic fluctuations since the retreat of the Wisconsin ice. Evidence in favor of at least one, and possibly more, "warm periods" or "climatic optima" since the wane of the Wisconsin ice comes from a number of sources.[1] Students of molluscan and other fossil faunas find remains of southern forms far north of their present ranges;[2] meteorologists consider that there was a post-glacial climatic optimum;[3] geologists and geographers[4] on the basis of studies of variation in the levels of lakes, movements of sand dunes, temperatures of underlying rocks, deposits of tufa, studies on the salinity of inland lakes, and the analysis of clay varves are led to this same general conclusion; on the basis of the cultural history of the people of the north, archeologists[5] conclude that there have been periods of more moderate climate in post-glacial time; botanical evidence, such as the presence of remains of *Alnus fruticosa* and *Betula alba* in the post-glacial silts of the New Siberian Islands;[6] the often noted tendency for many of the higher plants in the Arctic not to mature their seeds, studies in floristics,[7] and extensive pollen-

[1] *See* Die Veränderung des Klimas seit dem Maximum der letzten Eiszeit. Eine Sammlung von Berichten . . . herausgegeben von dem Executiv Komittee des 11. Internat. Geol. Kongr. Stockholm. 1910.

[2] Brøgger, W. C. Om de senglacials og post glaciale Nivå forandringer i Kristianiafeltet (Molluskfaunen). Norges Geol. Unders. no. 31. 1–731 (1900–1901).

Praeger, R. L. Report on the Raised Beaches of the north-east of Ireland, with special Reference to their Fauna. Proc. Roy. Irish. Acad., ser. 3., iv. 30–54 (1896).

[3] Simpson, l. c. 459, 463.

Köppen, W. and Wegener, A. Die Klimate der Geologischen Vorzeit. Berlin (1924).

Brooks, C. E. P. The Evolution of Climate. London (1922).

———. Climate threough the Ages. New York (1926).

———. Some Problems of modern Meteorology, No. 16. Post-glacial Climates and the Forests of Europe. Quart. Jour. Roy. Meteor. Soc., lx. 377 (1934).

[4] Ailio, J. Die geographische Entwicklung des Ladogasees in post-glazialer Zeit. Bull. Comm. Geol. Finlande. no. 45. 1–159 (1915).

Daly, R. A. The changing World of the Ice Age. New Haven (1934).

Coleman, A. P. Ice Ages, recent and ancient. New York. 1926.

Antevs, E. Retreat of the last Ice Sheet in eastern Canada. Can. Dep. Mines, Geol. Surv. Mem. no. 146 (1925).

———. The last Glaciation. Amer. Geogr. Soc. Res. Ser. no. 17 (1928).

[5] Sollas, W. J. Ancient Hunters. ed. 3, rev. New York (1924).

Nörlund, P. Buried Norsemen at Herjolfsnes. Meddel. Grønl., lxvii. no. 1. 1–270 (1924).

Curry, J. C. Climate and Migrations. Smiths. Rep. for 1929, 423–435 (1930).

[6] Mecking, L. The Polar Regions *in* The Geography of the Polar Regions. Amer. Geogr. Soc. Spec. Publ. no. 8 (1928).

[7] Gleason, H. A. The Vegetational History of the Middle West. Ann. Ass. Amer. Geogr., xii. 39–85 (1922); see also Science, n. s., lii. 340 (1920).

Printz, H. The Vegetation of the Siberian-Mongolian Frontiers. Contr. Flor. Asiae Inter. Pert. III (publ. by Kong. Norske Vidensk Selsk. 1921).

analytical investigations in this country and in Europe[1] point to a post-glacial "warm period." Doubtless there are errors here and there in the diversified investigations mentioned above, but the mass of the evidence strongly supports the general conclusion that at least one climatic optimum has occurred between late Wisconsin time and the present. This would make a promising working hypothesis for the interpretation of the post-glacial history of the flora of northeastern Labrador, if there were definite evidence for it from northeastern Labrador itself. Unfortunately no work of any kind has come to my attention which contributes to our knowledge of post-glacial climatic fluctuations in the region (or in Arctic America generally). However, the occurrence of a climatic optimum in northeastern Labrador is strongly suggested by the evidence from many other localities in arctic and temperate zones. As a third alternative, then, it is suggested that if Labrador had been completely ice-covered in the Wisconsin the present flora of northeastern Labrador owes its character in part to migrations northward of Laurentian plants, including some of the cordilleran relics, during a possible period of post-glacial climatic amelioration.[2] With subsequent refrigeration, there may have been a restriction of these relic species to more favorable localized areas (such as those of basic rock), or even a complete destruction of some of them, in northeastern Labrador.

In summarizing the various hypotheses suggested to explain the presence of cordilleran relics in the flora of northeastern Labrador, it is evident that a great deal depends on the interpretation of the behavior of the Wisconsin ice in the region. If the majority of geologists who have visited the region are correct, we may assume the presence of nunataks, a coastwise ice-free strip of land, and ice-free coastal islands, on all of which plants could have lived through the

[1] Sears, P. B. Post glacial Climate in eastern North America. Ecology, xiii. 1–8 (1932).

———. Glacial and post glacial Vegetation. Bot. Rev. i. 37–51 (1935).

von Post, L. Problems and Working Lines in the postarctic Forest History of Europe. Proc. Fifth Int. Bot. Congress, Cambridge. 48–54 (1931).

[2] The objection might be raised that a long enough period of time has not elapsed to permit such a migration *en masse* of a flora. One has but to refer to the observations of Professor W. S. Cooper (A Third Expedition to Glacier Bay, Alaska. Ecology. xii. 61–95 (1931)) to realize that the various components of the boreal flora can follow a retreating ice-margin with amazing and sufficient celerity.

It should also be emphasized that there is floristic evidence for the infiltration of some species from Greenland and the Arctic Archipelago into Northeastern Labrador. The agency involved is doubtless wind (see Simmons, Phytogeogr. Arct. Amer. Archipel., for a consideration of the important role played by wind in the dispersal of plants in the Arctic.).

maximum of glaciation. By analogy with Greenland today, especially northern Greenland (to which northern Labrador probably approached most closely in environmental conditions during the Wisconsin), it is suggested that cordilleran relics which today are limited to lower elevations in northeastern Labrador would probably not have survived on the wind-swept, overly well-drained nunataks. Nor from our knowledge of the extreme maritime climate of coastal islands is it likely that relic species would have survived there. But they may have survived in the favorable habitats at the heads of fiords where the desiccating power of the winds would have been felt least, and with a southerly exposure so that plants could have benefited from warmth obtained by direct insolation and have had melt-water available from the ice. Since relics have persisted in North Greenland in known areas of this type, this appears to explain best the persistence of cordilleran species in northern Labrador as well. However, if it is correct that the ice extended over all the land at the height of glacial development in the Wisconsin, then we must have recourse to a post-glacial migration of all plants, rather than their persistence in place. Under these circumstances, during the climatic optimum subsequent to the retreat of the ice, there may have been an immigration into northeastern Labrador of a contingent from the relic floras of the driftless areas of the St. Lawrence region. With subsequent refrigeration leading to our present climate there would have been a localization of the relic forms to the areas where they are found today. This hypothesis does violence to the concept of relics as senescent and non-aggressive species which have largely lost their power of migration. It also depends on the idea of a post-glacial climatic optimum, for which direct evidence from northeastern Labrador is lacking, although it appears to have been satisfactorily demonstrated elsewhere in the North. Therefore it should be tested further as new data become available. In the light of our present knowledge we must give preference to the theory that these cordilleran relics survived in protected habitats of relatively low altitude at or near the places where they today occur.

In conclusion, I should like to thank Professor M. L. Fernald for his unfailing interest and stimulating suggestions in the course of this study, as well as for his aid in the determination of the specimens. To other authorities of the Gray Herbarium, especially Mr. C. A. Weatherby, I am grateful for aid in connection with various phases of

this work. It is a pleasure to acknowledge the help given by Dr. H. M. Raup of the Arnold Arboretum, both in the taxonomy of Arctic plants and in the interpretation of their distribution. To the many others who have liberally given of their time and experience, and to my wife, Mrs. Lucy B. Abbe, who has helped in so many ways, I should also like to express my thanks.

Vascular Plants Collected in Labrador on the Grenfell-Forbes Northern Labrador Expedition, 1931

In the following list, the plants collected in Labrador only are noted, while the collections made in the short time spent in Newfoundland are omitted. Several members of the expedition helped in the collecting and to save space in the enumeration of plants, their names will be designated by the following abbreviations placed in parentheses after the number of each collection: (A) Ernst C. Abbe; (B) E. B. Brooks, jr.; (F) Miss K. Forbes; (H) Mrs. M. C. D. Hogg; (N) Noel Odell; (O) Mrs. M. Odell. Mention here should also be made of Mr. Hoyt Pease, who provided very efficient aid in Newfoundland up to the time he concluded his temporary connection with the expedition to join Dr. Grenfell.

Plants new to the coast of Newfoundland Labrador, as judged by the specimens in the Gray Herbarium, are marked with an asterisk (*). The arrangement of genera and species is essentially that of Engler and Prantl. Dates are not given but may be determined for the most part from the itinerary provided in the discussion of the botanical results of the expedition. The localities under each species are arranged in order from north to south along the coast.

When a species has been collected but a few times from the coast of Labrador I have taken occasion to mention the other stations from which it is known in the region. If the first occurrence on the coast is here noted, the distribution elsewhere in eastern North America is given in most cases.

Woodsia ilvensis (L.) R. Br. Scree slope, Valley of the Bryant Lakes, Kangalaksiorvik, no. 2 (A); face of cliff on north side of Razorback Harbor, no. 3 (A); Ogualik Island, no. 4 (O); gully from the lower ridge to the Valley of the Twin Falls, Kaumajet Mountains, no. 1 (A); in the Rev. P. Hettasch's rock garden at the Moravian Mission, Nain, nos. 600, 601 (A).

No. 600 was introduced by the Rev. Hettasch from the surrounding country, while he brought no. 601 into his garden from Hebron.

*W. GLABELLA R. Br. Gully from the lower ridge to the Valley of the Twin Falls, Kaumajet Mountains, no. 5 (A).

This collection provides an intermediate station between the northern known limit of the species in Greenland and the Arctic Archipelago, and its more southern occurrence in the Gulf of St. Lawrence region. Another possible intermediate station of this kind is that for POLYSTICHUM LONCHITIS (L.) Roth. The Rev. Hettasch reports this as growing on Ogualik Island but unfortunately it must remain as his "sight record" since he did not collect a specimen of it.

CYSTOPTERIS FRAGILIS (L.) Bernh. Old scree, Valley of the Bryant Lakes, Kangalaksiorvik, no. 8 (A); moist slope on north side of Razorback Harbor, no. 9 (A); mossy spot near waterfall, north side of Nachvak, no. 10 (B); on slaty talus slope, Rowsell Harbor, no. 7 (A & O); gully from the lower ridge to the Valley of the Twin Falls, Kaumajet Mountains, no. 6 (A).

EQUISETUM SYLVATICUM L., var. PAUCIRAMOSUM Milde. See Fernald, RHODORA, xx. 129 (1918). Mossy spot near waterfall, Nachvak, no. 12 (B).

LYCOPODIUM SELAGO L., var. APPRESSUM Desv. For this and the following species of *Lycopodium* see Marie-Victorin, Les Lycopodinées du Quebec (1925). Ridge extending south from East Bay, Ikordlearsuk, no. 14 (A & O); west side of the Valley of the Bryant Lakes, Kangalaksiorvik, no. 15 (A); summit of "K-2," north side of Komaktorvik, no. 16 (A).

L. ALPINUM L. See Porsild, Medd. Grønl. xciii. no. 3, 3 (1935). First ridge north of Kångalaksiorvik, no. 18 (A); moist slope on the north side of Razorback Harbor, no. 19 (A).

SELAGINELLA SELAGINOIDES (L.) Link. Moist, sphagnous tundra, Rodney Mundy Island, Indian Harbor, no. 20 (A & H).

JUNIPERUS COMMUNIS L., var. MONTANA Ait. In ericaceous mat, shore of Ittekaut Bay, Kikkivitak Island, no. 22 (A).

SPARGANIUM HYPERBOREUM Laestad. Shallow pool in rocks, Rodney Mundy Island, Indian Harbor, no. 23 (A & H).

This collection is characterised by well-developed fruits of the previous year. The species has been collected previously in Labrador by *Bishop* at Cape Harrigan, and by *Sewall* at Anatolak.

TRIGLOCHIN PALUSTRIS L. At stream-mouth near the Moravian Mission, Hopedale, no. 24 (A & H).

HIEROCHLOË ODORATA (L.) Wahlenb. Moist sphagnous tundra, Rodney Mundy Island, Indian Harbor, no. 101 (A & H).

H. ALPINA (Liljebl.) R. & S. On ridge extending south from East Bay, Ikordlearsuk, no. 107 (A & O); summit of "K-2," north side of Komaktorvik, no. 105 (A); morainal bench near the "K" River, Kangalaksiorvik, no. 104 (A); top of ridge north of Razorback Harbor, no. 108 (A); on the main ridge of Precipice Mountain, no. 106 (A); Valley of the Twin Falls, Kaumajet Mountains, no. 103 (A); near the top of the hill back of Battle Harbor, no. 102 (A).

*Alopecurus aequalis Sob., var. natans (Wahlenb.) Fernald. See Fernald, Rhodora, xxvii. 196 (1925). In tundra pool near west shore of the island, Kikkertaksoak, Saglek, no. 100 (A).

Otherwise known in eastern North America from Greenland and the Gulf of St. Lawrence area.

*Phippsia algida (Soland.) R. Br. Near the mouth of stream emptying into East Bay, Ikordlearsuk, no. 99 (A); on moist, meadowy hillsides, Near Island (Amiktok), Kangalaksiorvik, no. 98 (A); on a very wet spot left by a melting snow bank, lower slopes of "K-2," Komaktorvik, no. 97 (A).

Also known from Greenland, the Arctic Archipelago, Port Burwell on Ungava Bay, and Hudson Strait.

Agrostis borealis Hartm. See Fernald, Rhodora, xxxv. 203 (1933). Moist meadowy hillsides on Near Island (Amiktok), Kangalaksiorvik, no. 89 (A); scree slide from the top of Precipice Ridge to Komaktorvik Lake, no. 87 (A); north shore of Komaktorvik Lake, no. 88 (A); Ogualik Island, no. 90 (B); hilltop above large sphagnum bog, Kikkivitak Island, Ittekaut Bay, no. 91 (A); in the Salix-Empetrum mat near the old Eskimo village back of Hopedale, no. 86 (A & H); moist, mossy spot near the top of the hill back of Battle Harbor, no. 85 (A).

Calamagrostis canadensis (Michx.) Nutt., var. robusta Vasey. See Inman, Rhodora, xxiv. 142 (1922); Stebbins, Rhodora, xxxii, 42 (1930). North shore of the fiord, Kangalaksiorvik, no. 92 (F & O); mossy spot near waterfall on the north side of Nachvak, no. 93 (B).

C. neglecta (Ehrh.) Gaertn. See Stebbins, l. c. 53. Shores of Seaplane Cove, Kangalaksiorvik, no. 94 (O & H).

C. neglecta (Ehrh.) Gaertn., var. borealis (Laestad.) Kearney. See Stebbins, l. c. 55. Shores of Seaplane Cove, Kangalaksiorvik, nos. 95, 96 (O & H).

Deschampsia alpina (L.) Roem. and Schult. In mossy spot near mouth of stream emptying into the south side of East Bay, Ikordlearsuk, no. 82 (A & O); in the tundra above the anchorage, Ryans Bay, no. 81 (A & O); north shore of Kangalaksiorvik, no. 80 (F & O).

Deschampsia flexuosa (L.) Trin. North shore of Komaktorvik Lake, no. 76 (A); in the valley of the Komaktorvik River, no. 77 (A); moist, open place in a grove of spruce and fir, Kikkivitak Island, Ittekaut Bay, no. 78 (A); near stream on upper slopes of hill back of Battle Harbor, no. 79 (A).

This material has the longer spikelets (0.4 to 0.6 mm.) of the Arctic and European mountain specimens, as well as their slightly less open inflorescence and less delicate branchlets of the panicles, thus differing from the plants of the more southern part of the range of this species in North America. This material may well be *D. flexuosa* var. *montana* (L.) Trin.

D. ATROPURPUREA (Wahlenb.) Scheele. In the tundra above the anchorage, Ryans Bay, no. 83 (A & O); in the valley of the Komaktorvik River, no. 84 (A).

TRISETUM SPICATUM (L.) Richter. For this and its varieties see Fernald, RHODORA, xviii. 195 (1916). Ogualik Island, no. 69 (B).

T. SPICATUM (L.) Richter, var. MAIDENII (Gandoger) Fernald. Near the mouth of the "K" River, Kangalaksiorvik, no. 71 (A); moist gully on south side of cliff on north side of Razorback Harbor, no. 72 (A); between beach and slaty talus slope, no. 70 (A & O); restricted moist area on the ridge leading up to the easterly summit of the Bishop's Mitre, Kaumajet Mountains, no. 73 (A).

T. SPICATUM (L.) Richter, var. PILOSIGLUME Fernald. Scree slide from the top of Precipice Ridge to Komaktorvik Lake, no. 75 (A); in Salix-Empetrum mat near the old Eskimo village back of Hopedale, no. 74 (A & H).

POA ALPINA L. On the north side of the fiord, Kangalaksiorvik, no. 42 (A); in the valley of the Komaktorvik River, no. 41 (A); near the summit of the Bishop's Mitre, Kaumajet Mountains, no. 43 (A).

P. ALPINA L., var. BREVIFOLIA Gaudin. Between the beach and the slaty, talus slope, Rowsell Harbor, no. 39 (A & O).

P. GLAUCA M. Vahl. (*cf.* J. A. Nannfeldt, Symbol. Bot. Ups. v. (1935)). At the margins of soil polygons on the second summit of Ikordlearsuk Mountain, Ikordlearsuk, no. 60 (A); west side of the Valley of the Bryant Lakes, Kangalaksiorvik, nos. 51, 52 (A); spur on the southwest side of Mount Tetragona, Kangalaksiorvik, nos. 47, 50 (A); flood-plain of the "K" River, Kangalaksiorvik, no. 46 (A); on the top of Precipice Mountain, no. 49 (A); top of ridge north of Razorback Harbor, no. 53A; scree slide from the top of Precipice Ridge to Komaktorvik Lake, no. 48 (A); in an exceptional and restricted, moist, mossy area on the dry ridge leading to the east summit of the Bishop's Mitre, no. 61 (A); on Odell's Peak west of the Bishop's Mitre, no. 54 (N); in the Valley of the Twin Falls, Kaumajet Mountains, nos. 44, 45 (A).

P. ARCTICA R. Br. (*P. rigens* of Lindman, perhaps not of Hartm. See Nannfeldt, Symb. Bot. Ups. iii. (1934)). Moist swaley place near stream in the Valley of the Bryant Lakes, Kangalaksiorvik, no. 65 (A); north shore of Kangalaksiorvik, no. 59 (F & O); on the summit of "K-2," Komaktorvik, no. 64 (A); on morainal bench near the "K" River, Kangalaksiorvik, no. 63 (A); in the valley of the Komaktorvik River, no. 58 (A); between the beach and the slaty talus slope, Rowsell Harbor, no. 56 (A & O); on the easterly summit of the Bishop's Mitre, Kaumajet Mountains, no. 66 (A).

P. ALPIGENA (Fr.) Lindm. See Lindman in Lynge, Rep. Sci. Res.

Norw. Exp. Novaya Zemlya, 1921, no. 13. 114 (1923). In the valley of the Komaktorvik River, no. 611 (A); on the scree slope from the top of Precipice Ridge to Komaktorvik Lake, no. 57 (A); between the beach and the base of the slaty talus slope, Rowsell Harbor, no. 55 (A & O); in the tundra beyond the wireless station at Battle Harbor, no. 62 (A).

Dupontia psilosantha Rupr. Upper margin of the beach on the south side of East Bay, Ikordlearsuk, no. 67 (A & O).

Puccinellia phryganodes (Trin.) Scribn. & Merr. See Fernald and Weatherby, Rhodora, xviii. 8 (1916). Near the mouth of a stream emptying into the south side of East Bay, Ikordlearsuk, no. 26 (A & O); on the shores of Seaplane Cove, Kangalaksiorvik, no. 25 (O & H).

This is known from the coast of Labrador by the previous collection made by Sornborger at Nain in 1897 It was also collected from Port Burwell on Ungava Bay in 1927 and 1928 by M. O. Malte.

Festuca rubra L. See Fernald, Rhodora, xxxv. 132 (1933). In "The Park," Hopedale, no. 38 (A, H & F).

F. brachyphylla Schultes. West side of the Valley of the Bryant Lakes, Kangalaksiorvik, no. 33 (A); on the summit of "K-2," north side of Komaktorvik, no. 30 (A); in the valley of the Komaktorvik River, no. 32 (A); on the ridge north of Razorback Harbor, nos. 34, 35, 36 (A); scree slide from the top of Precipice Ridge to Komaktorvik Lake, no. 31 (A); between the beach and the slaty talus slope, Rowsell Harbor, no. 29 (A & O); in Salix-Empetrum mat near the old Eskimo village, Hopedale, no. 28 (A & H).

Festuca brachyphylla Schultes and *Festuca supina* Schur have been thoroughly confused in the literature on arctic botany. They are, however, beautifully distinct taxonomically, *F. brachyphylla* having anthers from 0.5 to 1.2 mm. long and the leaf-sheaths split to the base, while *F. supina* has the anthers 1.8 to 3.0 mm. long and the leaf-sheaths split but two-thirds or three-quarters of the way to the base. Other characters exist as well,[1] but an examination of the material in the Gray Herbarium indicates that those mentioned are the most serviceable ones. *F. brachyphylla* was described by Robert Brown[2] in 1824 as *F. brevifolia,* but due to the earlier *F. brevifolia* Muhl., 1817, the first valid name is *F. brachyphylla* Schultes.[3] Brown in his description does not specify either the length of the anthers or the nature of the leaf-sheath, but fortunately there is a co-type of his *F. brevifolia* at the Gray Herbarium, which upon examination substantiates the characters given above.

[1] Fernald, Rhodora, xxxvii. 250 (1935).
[2] Brown, R. Chloris Melvilliana. App. Parry's Voy. Suppl. 289 (1824)
[3] Schultes, Mant. iii. 646 (1827).

Mention should be made of a persistent error. Hackel[1] characterises the sheath of *F. brachyphylla* as "omnino v. saltem a basi ultra medium usque integrae" although at the same time he gives the anther-dimensions correctly in his key. This mistake was perpetuated by Piper[2] when he described the sheaths as "closed their whole length or nearly." As recently as 1925, Saint-Yves[3] repeats the old error, although Simmons[4] had detected it in 1906.

F. VIVIPARA (L.) Sm. See Fernald, RHODORA, xxxvii. 250 (1935). Near the top of the hill back of Battle Harbor, no. 37 (A).

ELYMUS ARENARIUS L., var. VILLOSUS E. Mey. See St. John, RHODORA, xvii. 98 (1915). In "The Park," Hopedale, no. 68 (A, H & F).

ERIOPHORUM SCHEUCHZERI Hoppe. See Fernald, RHODORA, xxvii. 203 (1925). Moist area between "K-1" and "K-2," Komaktorvik, no. 113 (A); seaward side of hill back of Battle Harbor, no. 112 (A).

E. SPISSUM Fernald. North shore of Komaktorvik Lake, no. 116 (A); near the top of the hill back of Battle Harbor, no. 115 (A).

E. ANGUSTIFOLIUM Roth. See Fernald, RHODORA, vii. 88 (1905) West side of the Valley of the Bryant Lakes, Kangalaksiorvik, no. 120 (A); in a large sphagnum bog on Kikkivitak Island, Ittekaut Bay, no. 121 (A); in a sphagnous meadow beside a lake on Gready Island, no. 119 (A & H).

SCIRPUS CESPITOSUS L., var. CALLOSUS Bigelow. See Fernald, RHODORA, xxiii. 22 (1921). In the dry ericaceous mat, shore of Kikkivitak Island, Ittekaut Bay, no. 110 (A).

KOBRESIA BELLARDI (All.) Degland. See Mackenzie, N. A. Flora, xviii. 4 (1931). On the west side of the Valley of the Bryant Lakes, Kangalaksiorvik, no. 123 (A).

*CAREX CAPITATA L. In the Valley of the Komaktorvik River, no. 124 (A); in the tundra near the west shore of Kikkertaksoak Island, Saglek Bay, no. 125 (A).

The only other collection in the Gray Herbarium of this from the Labrador peninsula is that made by *Malte* at Port Harrison on the east coast of Hudson Bay.

*C. MARITIMA Gunner (*C. incurva* Lightf.). See Fernald, RHODORA, xxxv. 395 (1933). Sandy stream bank, Near Island (Amiktok), Kangalaksiorvik, no. 126 (A).

Otherwise known from Greenland, the Arctic Archipelago, Newfoundland and Hudson Bay in eastern North America.

[1] Hackel, E. Monographia Festucarum Europaearum, 82. Berlin (1882).

[2] Piper, C. V. North American Species of Festuca. Contr. U. S. Nat. Herb. x. pt. 1, 27 (1906).

[3] Saint-Yves, A. Contr. a l'étude des Festuca (Subgen. Eu-Festuca) de l'Amérique du Nord et du Mexique. Candollea, ii. 257 (1925).

[4] Simmons, H. G. Vascular Plants in the Flora of Ellesmereland. Rep. Sec. Nor. Arc. Exp. "Fram" 1898–1902. no. 2, 154 (1906).

C. bipartita All. (*C. Lachenalii* Schkuhr). See Mackenzie, Bull. Torr. Bot. Club, l. 348 (1923). Scree on the south side of Peak 19, The Four Peaks, Kangalaksiorvik, no. 128 (A); on the north side of Kangalaksiorvik, no. 127 (O & F).

C. glareosa Wahl. Tundra above the anchorage at Ryans Bay, no. 129 (A & O).

C. canescens L. Stream-margin just above large sphagnum bog on Kikkivitak Island, Ittekaut Bay, no. 130 (A).

C. scirpoidea Michx. Moist, meadowy hillsides on Near Island (Amiktok), Kangalaksiorvik, no. 135 (A); summit of "K-2," north side of Komaktorvik, no. 134 (A); moist gully in cliff on the north side of Razorback Harbor, no. 136 (A); on slaty talus slope, Rowsell Harbor, no. 133 (A & O); moist, sphagnous tundra near small brook on Rodney Mundy Island, Indian Harbor, no. 132 (A & H).

Number 136 is of interest in that it has brown rather than the more usual purple scales.

C. capillaris L. On moist meadowy hillsides, Near Island (Amiktok), Kangalaksiorvik, no. 143 (A); near the summit of "K-2," north side of Komaktorvik, no. 142 (A); on slaty talus slope, Rowsell Harbor, no. 141 (A & O); seaward side of the island, Battle Harbor, no. 140 (A).

*C. misandra R. Br. On a moist bench near the summit of the Bishop's Mitre, Kaumajet Mountains, no. 145 (A); on the lower ridge east of the Valley of the Twin Falls, no. 144 (A).

This has been collected elsewhere on the Labrador peninsula by *M. O. Malte* at Port Burwell on Ungava Bay in 1927.

C. rariflora (Wahlenb.) Smith. Moist, meadowy hillsides on Near Island (Amiktok), Kangalaksiorvik, no. 147 (A); in a large sphagnum bog on Kikkivitak Island, Ittekaut Bay, no. 148 (A); in a sphagnous meadow on Gready Island, no. 146 (A & H).

C. paupercula Michx. In a large sphagnum bog on Kikkivitak Island, Ittekaut Bay, no. 149 (A).

C. Vahlii Schkuhr (*C. alpina* Swartz). See Fernald, Rhodora, xxxv. 398 (1933). On moist, meadowy hillsides, Near Island (Amiktok), Kangalaksiorvik, no. 150 (A); between the beach and talus, Rowsell Harbor, no. 153 (A & O).

C. concolor R. Br. (*C. rigida* Good.). In boggy meadow at the foot of the ridge south of East Bay, Ikordlearsuk, no. 160 (A & O); on ridge extending south from East Bay, Ikordlearsuk, no. 158 (A & O); moist meadowy hillsides, Near Island (Amiktok), Kangalaksiorvik, no. 157 (A); top of the ridge north of Razorback Harbor, no. 159 (A); on the main ridge, Precipice Ridge, no. 156 (A); Ogualik Island, no. 161 (B); in the Valley of the Twin Falls, Kaumajet Mountains, no. 155 (A); moist sphagnous tundra, Rodney Mundy Island, Indian Harbor, no. 154 (A & H).

C. AQUATILIS Wahlenb. On the shore of a pond in the large sphagnum bog on Kikkivitak Island, Ittekaut Bay, no. 164 (A); in "The Park," Hopedale, no. 163 (A, H & F); in a sphagnous meadow beside lake on Gready Island, no. 162 (A & H).

*C. SUBSPATHACEA Wormskj. Near the mouth of a stream emptying into the south side of East Bay, Ikordlearsuk, no. 165 (A & O).

This rare little sedge is known otherwise in eastern North America from Greenland and the Gulf of St. Lawrence region.

*C. MICROGLOCHIN Wahlenb. Moist, meadowy hillsides, Near Island (Amiktok), Kangalaksiorvik, no. 166 (A).

Formerly known primarily from Greenland and the Gulf of St. Lawrence region in eastern North America. It is characterized by Professor Fernald[1] as "one of the most famous of rarest sedges."

C. SAXATILIS L., var. RHOMALEA Fernald. See Fernald, RHODORA, iii. 50 (1901). In tundra above the anchorage, Ryan's Bay, no. 168 (A & O); in the valley of the Komaktorvik River, no. 167 (A); tundra near the west shore of the island, Kikkertaksoak, Saglek, nos. 169, 170 (A); at base of the cliff near the spruce-fir grove on Kikkivitak Island, Ittekaut Bay, no. 171 (A).

C. MEMBRANOPACTA Bailey. At the margins of the bog on the south side of East Bay, Ikordlearsuk, no. 172 (A & O).

LUZULA PARVIFLORA (Ehrh.) Desv. In "The Park," Hopedale, no. 184 (A, H & F).

L. CONFUSA Lindeb. On the margins of soil polygons on top of the first peak, Ikordlearsuk Mountain, Ikordlearsuk, no. 198 (A); margins of soil polygons on top of the second peak, Ikordlearsuk Mountain, no. 197 (A); on the ridge extending south from East Bay, Ikordlearsuk, nos. 195, 196 (A & O); shores of Seaplane Cove, Kangalaksiorvik, no. 194 (O & H); on the morainal bench above the anchorage, Kangalaksiorvik, no. 189 (A); on the summit of "K-2," north side of Komaktorvik, no. 190 (A); in the valley of the Komaktorvik River, no. 193 (A); top of ridge north of Razorback Harbor, no. 604 (A); on the main ridge, Precipice Ridge, north of Komaktorvik Lake, no. 192 (A); on top of Precipice Mountain, Torngat Mountains, no. 191 (A); on the westerly summit of the Bishop's Mitre, Kaumajet Mountains, no. 199 (A); on the easterly summit of the Bishop's Mitre, no. 200 (A); on Odell's peak west of the Bishop's Mitre, Kaumajet Mountains, no. 605 (N); on the upper ridge above the Valley of the Twin Falls, Kaumajet Mountains, no. 188 (A).

L. SPICATA (L.) DC. On the summit of "K-2," north side of Komaktorvik, no. 185 (A); top of the ridge north of Razorback Harbor, no. 187 (A); scree slide from the top of Precipice Ridge to Komaktorvik Lake, no. 186 (A); on the bare hilltops of Hawkes Island, no. 603 (A).

[1] Fernald, RHODORA, xxviii. 53, 54 (1926).

L. campestris (L.) DC., var. frigida Buch. See Fernald and Wiegand, Rhodora, xv. 38 (1913). In moist gully in cliff on the north side of Razorback Harbor, no. 202 (A).

Juncus trifidus L. In a mossy spot near waterfall on the north side of Nachvak, no. 174 (B); Ogualik Island, no. 175 (O).

J. filiformis L. On the bank of a stream entering sphagnum bog on Kikkivitak Island, Ittekaut Bay, no. 176 (A).

J. biglumis L. Near the mouth of a stream emptying into the south side of East Bay, Ikordlearsuk, no. 177 (A & O).

The only previous collection from the coast of Labrador is that of *Woodworth* made in 1926 on a rocky hillside, "Ekortiarsuk" Bay (= Ikordlearsuk). It was collected by *Malte* at Port Burwell in 1927 and at Wakeham Bay in 1928, and is also known on the Arctic Archipelago, in Greenland, and on the Arctic coast of North America.

J. albescens (Lange) Fernald. See Fernald, Rhodora, xxvi. 202 (1928), and Rhodora, xxxv. 236 (1933). In the valley of the Komaktorvik River, no. 179 (A); between the beach and the slaty talus slope, Rowsell Harbor, no. 178 (A & O).

J. castaneus Smith. Moist, meadowy hillsides, Near Island (Amiktok), Kangalaksiorvik, no. 182 (A); in the valley of the Komaktorvik River, no. 181 (A); between the beach and slaty talus slopes of the south side of Rowsell Harbor, no. 180 (A & O).

Tofieldia minima (Hill) Druce (*T. palustris* Hudson). On the west side of the Valley of the Bryant Lakes, Kangalaksiorvik, no. 206 (A); gully from the lower ridge to the Valley of the Twin Falls, Kaumajet Mountains, no. 203 (A); in the Valley of the Twin Falls, no. 204 (A).

Smilacina trifolia (L.) Desf. Near the top of the hill back of Battle Harbor, no. 205 (A).

Habenaria dilatata (Pursh) Hook. See Ames, Orchidaceae, iv. 62 (1910). In a moist, mossy place beyond the wireless station on the hill back of Battle Harbor, no. 207 (A).

H. obtusata (Pursh) Richards., var. collectane Fernald. See Fernald, Rhodora xxviii. 175 (1926). On the margin of a small lake in the tundra, Aillik, no. 208 (A).

Corallorrhiza trifida Chat. In a patch of bare, wet clay near the shore of Rodney Mundy Island, Indian Harbor, no. 209 (A & H).

Salix reticulata L. Between the beach and the slaty talus, Rowsell Harbor, no. 210 (A & O).

Previously collected in Labrador by Woodworth at Ryan's Bay in 1926.

S. vestita Pursh. See Fernald and St. John, Can. Dep. of Mines, Mem. 126. 44 (1922). Mossy spot near waterfall on the north side of Nachvak, no. 213 (B); on slaty talus slope, Rowsell Harbor, no. 212 (A & O); on dry hillside above the tundra near the west shore of the island, Kikkertaksoak, Saglek, no. 214 (A); just below the easterly summit of the Bishop's Mitre, Kaumajet Mountains, no. 216 (A); Ogualik Island, no. 215 (B).

S. Uva-ursi Pursh. On the west side of the Valley of the Bryant Lakes, Kangalaksiorvik, no. 221 (A); on the main ridge of Precipice Ridge, no. 220 (A); on the upper ridge above the Valley of the Twin Falls, Kaumajet Mountains, no. 219 (A); in the tundra on the seaward side of the island, Battle Harbor, no. 218 (A).

S. herbacea L. West side of the Valley of the Bryant Lakes, Kangalaksiorvik, no. 225 (A); margins of soil polygons on the upper ridge above the Valley of the Twin Falls, Kaumajet Mountains, no. 224 (A); at the base of the hill back of the Moravian Mission, Hopedale, no. 223 (A & H); in the sides of a moist crevice near the top of a hill on Rodney Mundy Island, Indian Harbor, no. 222 (A & H).

S. anglorum Cham. For this species and its varieties see Schneider, Bot. Gaz. lxvi. 126 (1918). West side of the Valley of the Bryant Lakes, Kangalaksiorvik, no. 232 (A); on the rock ridge approaching the east summit of the Bishop's Mitre, Kaumajet Mountains, no. 233 (A); at the base of the hill back of the Moravian Mission, Hopedale, no. 227 (A & H).

S. anglorum Cham., var. kophophylla Schn. On the west side of the Valley of the Bryant Lakes, Kangalaksiorvik, no. 231 (A); in the moist sphagnum near the top of the hill back of Battle Harbor, no. 226 (A).

Number 231 is an extreme type with cordate leaves and the twigs puberulous.

*S. anglorum Cham., var. araioclada Schn. Halfway down the scree on the south side of Peak 19, The Four Peaks, Kangalaksiorvik, no. 229 (A); on the steep bank of the "K" River, no. 228 (A).

Heretofore known only from the Gaspé Peninsula and the Rocky Mountains.

S. arctophila Cockerell. On Rodney Mundy Island, Indian Harbor, no. 235 (A & H); near the top of the hill back of Battle Harbor, no. 234 (A).

S. cordifolia Pursh, var. typica Fernald. For this species and its varieties see Fernald, Rhodora, xxviii. 181 (1926); also Schneider, Bot. Gaz. lxvi. 343 (1918). On dry, gravelly slopes, Near Island (Amiktok), Kangalaksiorvik, no. 230 (A).

S. cordifolia Pursh, var. callicarpaea (Trautv.) Fernald. On slaty talus slope, Rowsell Harbor, no. 244 (A & O); at the margin of a large sphagnum bog on Kikkivitak Island, Ittekaut Bay, no. 249 (A); on hilltop near the harbor, Gready Island, no. 241 (A & H); on the seaward side of the island, Battle Harbor, no. 240 (A).

S. cordifolia Pursh, var. intonsa Fernald. Mossy spot near waterfall on the north side of Nachvak, no. 247 (B); dry hillside above tundra near the west shore of the island, Kikkertaksoak, Saglek, no. 248 (A); in the tundra on Rodney Mundy Island, Indian Harbor, no. 243 (A & H).

S. cordifolia Pursh, var. Macounii (Rydberg) Fernald. On the west side of the Valley of the Bryant Lakes, Kangalaksiorvik, no. 246 (A); in the moist tundra near a small brook, Rodney Mundy Island, Indian Harbor, no. 242 (A & H).

S. calcicola Fernald & Wiegand. On the bank of the "K" River near "K-1," Kangalaksiorvik, no. 252 (A); on slaty talus slope, Rowsell Harbor, no. 251 (A & O); in the Valley of the Twin Falls, Kaumajet Mountains, no. 250 (A).

S. planifolia Pursh. See Schneider, Jour. Arnold Arboretum, i. 75 (1919). In the valley of the Komaktorvik River, no. 255 (A); in a gully on the peninsula at Aillik, no. 254 (A).

S. argyrocarpa Anderss. In the valley of the Komaktorvik River, no. 245 (A).

Myrica Gale L. In the tundra beyond the wireless station, Battle Harbor, no. 256 (A).

Alnus crispa (Ait.) Pursh. Mossy spot near waterfall on the north side of Nachvak, no. 257 (B).

Betula glandulosa Michx. In moist sphagnous tundra, Rodney Mundy Island, Indian Harbor, no. 258 (A & H).

Koenigia islandica L. Near mouth of stream on the south side of East Bay, Ikordlearsuk, no. 264 (A & O); on mossy stream-bank, Near Island (Amiktok), Kangalaksiorvik, no. 263 (A); moist gravel under overhanging rocks, Gready Island, no. 262 (A & F).

Oxyria digyna (L.) Hill. On a restricted, moist, mossy area on the western end of the ridge near the east summit of the Bishop's Mitre, Kaumajet Mountains, no. 261 (A); in the Valley of the Twin Falls, no. 259 (A); in the gully from the Valley of the Twin Falls to the lower ridge, no. 260 (A).

Polygonum viviparum L. In sphagnum on Near Island (Amiktok), Kangalaksiorvik, no. 267 (A).

Silene acaulis L., var. exscapa (All.) DC. See Fernald and St. John, Rhodora, xxiii. 119 (1921). On gravelly slope above the tundra near the anchorage, Ryan's Bay, no. 324 (A & O); within 100 m. of the top of "K-2," north side of Komaktorvik, nos. 321, 322 (A); valley of the "K" River, Kangalaksiorvik, no. 320 (A).

Lychnis furcata (Raf.) Fernald (*L. affinis* J. Vahl). See Fernald, Rhodora, xxxiv. 22 (1932). On the dry slope of the ridge south of East Bay, Ikordlearsuk, no. 318 (A & O); old scree slope on the west side of the Valley of the Bryant Lakes, no. 319 (A); near the summit of "K-2," north of Komaktorvik, no. 317 (A).

Lychnis alpina L. In moist gully in cliff on the north side of Razorback Harbor, no. 316 (A); in the Valley of the Twin Falls, Kaumajet Mountains, no. 315 (A); crack in rock on the seaward side of Gready Island, no. 313 (O).

Cerastium alpinum L. For this species and its varieties see Fernald and Wiegand, Rhodora, xxii. 169 (1920). In a moist place on a hill-top near Gready Harbor, no. 297 (A & H).

C. alpinum L., var. glanduliferum Koch. On the ridge north of Razorback Harbor, no. 302 (A); in a restricted, moist area on a rock ridge near the east summit of the Bishop's Mitre, Kaumajet Mountains, no. 303 (A).

C. alpinum L., var. lanatum (Lam.) Hegetschw. Moist, meadowy hillsides, Near Island (Amiktok), Kangalaksiorvik, no. 301 (A); on the northeast shoulder of Precipice Mountain, no. 300 (A); between the beach and the slaty talus, Rowsell Harbor, no. 299 (A & O); on the sides of a moist crevice near the top of a hill on Rodney Mundy Island, Indian Harbor, no. 298 (A & H).

*C. Beeringianum Cham. & Schlecht. In moist gully in cliff on the north side of Razorback Harbor, no. 305 (A); in mossy tundra, north shore of Komaktorvik Lake, no. 304 (A).

C. arvense L. Ogualik Island, no. 306 (B).

C. cerastioides (L.) Britton. In gravelly stream-bed in the edge of the tundra above the anchorage, Ryan's Bay, no. 311 (A & O); on a sandy stream-bank, Near Island (Amiktok), Kangalaksiorvik, no. 310 (A); on the north shore of Kangalaksiorvik, no. 309 (O & F); on the shores of Seaplane Cove, Kangalaksiorvik, no. 307 (A); moist gully in cliff on the north side of Razorback Harbor, no. 312 (A); scree slide from the top of Precipice Ridge to Komaktorvik Lake, no. 308 (A).

Stellaria longipes Goldie. Near a little pond in the tundra above the anchorage, Ryan's Bay, no. 293 (A & O); on the shores of Seaplane Cove, Kangalaksiorvik, no. 292 (A); between the beach and talus, Rowsell Harbor, no. 291 (A & O); Ogualik Island, no. 295 (B); mossy spot near the landing, Gready Island, no. 290 (A & F); in the Salix-Empetrum complex, Gready Island, no. 289 (A & H).

S. crassifolia Ehrh. Near the Eskimo remains, shore of Seaplane Cove, Kangalaksiorvik, no. 285 (O).

S. humifusa Rottb. Margins of soil polygons, Near Island (Amiktok), Kangalaksiorvik, no. 287 (A); in moss by brook, Near Island (Amiktok), Kangalaksiorvik, no. 288 (A); shores of Seaplane Cove, Kangalaksiorvik, no. 286 (A).

Arenaria verna L., var. pubescens (Cham. & Schl.) Fernald. See Fernald, Rhodora, xxi. 21 (1919). On scree on the south side of Peak 19, The Four Peaks, Kangalaksiorvik, no. 275 (A); between "K-2" and the "K" River, Kangalaksiorvik, no. 607 (A); near "K-2," Komaktorvik, no. 274 (A); near the easterly summit of the Bishop's Mitre, Kaumajet Mountains, no. 276 (A); in cracks in the bare rock top of hilltop near the harbor, Rodney Mundy Island, Indian Harbor, no. 268 (A & H).

A. verna L., var. pubescens (Cham. & Schl.) Fern., forma epilis Fernald. Between the beach and the slaty talus, Rowsell Harbor, no. 273 (A & O).

This form was collected by *Sornborger* at Rama in 1897.

A. humifusa Wahlenb. (*A. cylindrocarpa* Fern.) See Fernald, Rhodora, xvi. 43 (1914) and Rhodora, xxxv. 11 and 265 (1933); also Nordhagen, Bergens Museums Årbok, 1935, Natur. rekke, No. 1 (1935). On slaty talus slope, Rowsell Harbor, no. 284 (A & O).

A. groenlandica (Retz.) Spreng. See Fernald, Rhodora, xxi. 17 (1919). Moist, gravelly areas among rocks, Kikkivitak Island, Ittekaut Bay, no. 272 (A); in cracks in the rock top of hill back of the Moravian Mission, Hopedale, no. 271 (A & H).

A. sajanensis Willd. See Fernald, Rhodora, xxi. 12 (1919). Moist, mossy slope of the ridge south of East Bay, Ikordlearsuk, no. 281 (A & O); dry, gravelly patch of soil in tundra above the anchorage, Ryan's Bay, no. 277 (A & O); shores of Seaplane Cove, Kangalaksiorvik, no. 280 (A); top of ridge north of Razorback Harbor, no. 282 (A); on the margins of soil polygons, upper ridge above the Valley of the Twin Falls, Kaumajet Mountains, no. 278 (A); easterly slope of the Bishop's Mitre, no. 283 (A); lower ridge above the Valley of the Twin Falls, no. 279 (A).

Sagina nivalis Fries. At the mouth of a stream emptying into the south side of East Bay, Ikordlearsuk, no. 270 (A & O); on the margins of soil polygons, upper ridge above the Valley of the Twin Falls, Kaumajet Mountains, no. 269 (A).

Montia lamprosperma Cham. See Fernald and Wiegand, Rhodora, xii. 138 (1910). At a stream-mouth, Near Island (Amiktok), Kangalaksiorvik, no. 613 (A).

This was called to my attention by Dr. R. A. Laubengayer in a lot of preserved *Koenigia islandica* with which it was mixed.

Anemone parviflora Michx. On slaty, talus slope, Rowsell Harbor, no. 342 (A & O); in the Valley of the Twin Falls, Kaumajet Mountains, no. 343 (A).

Ranunculus trichophyllus Chaix, var. eradicatus (Laestad.) W. B. Drew, *fide* Drew, Rhodora, xxxviii. 33 (1936). Pool in rocks on Near Island (Amiktok), Kangalaksiorvik, no. 325 (A).

R. reptans L. See Fernald, Rhodora, xix. 135 (1917). Moist, gravelly area in the tundra near the west shore of Kikkertaksoak Island, Saglek, no. 326 (A).

R. nivalis L. See Holm, Rep. Can. Arc. Exp. 1913–18, v. pt. B, 32 (1922). On the moist, mossy slope of the ridge to the south of East Bay, Ikordlearsuk, no. 328 (A & O); steep, wet bank of the "K" River, Kangalaksiorvik, no. 327 (A).

R. pygmaeus Wahlenb. See Fernald, Rhodora, xix. 138 (1917). On the ridge extending south from East Bay, Ikordlearsuk, no. 335 (A & O); mossy stream-bank, edge of the tundra above the anchorage, Ryan's Bay, no. 334 (A & O); spur on the southwest side of Mount Tetragona, no. 333 (A); valley of the "K" River, Kangalaksiorvik, no. 332 (A); on slaty talus slope, Rowsell Harbor, no. 331 (A & O);

on a restricted moist, mossy area on ridge near the east summit of the Bishop's Mitre, Kaumajet Mountains, no. 336 (A).

R. ALLENII Robinson. In the Valley of the Twin Falls, Kaumajet Mountains, nos. 329, 330 (A).

*R. PEDATIFIDUS J. E. Smith, var. LEIOCARPUS (Trautv.) Fernald (*R. affinis* R. Br.). See Fernald, RHODORA, xix. 138 (1917); and idem, xxxvi. 93 (1934). Mossy shore of lake south of East Bay, Ikordlearsuk, no. 338 (A & O); in the Valley of the Twin Falls, Kaumajet Mountains, no. 337 (A).

Otherwise known in eastern North America from Greenland, the Arctic Archipelago, Ungava, Newfoundland and the Gaspé Peninsula.

PAPAVER RADICATUM Rottb. See Hultén, Kungl. Svensk. Vetensk. Akad. Handl., ser. 3, v. no. 2, 138 (1928); also Simmons, Rep. Sec. Norw. Arc. Exp. "Fram" 1898–1902, pt. 2, 99 (1906). On the margins of soil polygons on the top of Ikordlearsuk Mountain, no. 349 (A); near "K-2," north side of Komaktorvik, no. 348 (A); on the west summit of the Bishop's Mitre, Kaumajet Mountains, no. 350 (A); lower ridge above the Valley of the Twin Falls, Kaumajet Mountains, no. 347 (A); on the slopes of the upper ridge above the Valley of the Twin Falls, Kaumajet Mountains, no. 346 (A); on the edge of soil polygon, on the upper ridge above the Valley of the Twin Falls, no. 345 (A).

Number 347 from the Kaumajet region was white-petalled. It was the only plant noted during the summer that had this character, but it is of interest in view of Gelting's[1] observations on the white-petalled form in Greenland that my specimen also lost its petals with even greater ease than do the yellow-petalled ones.

Whether the white-petalled form observed in northeastern Labrador is identical with that discussed by Nannfeldt (Symbol. Bot. Upsal. v. 84. (1935)) it is difficult to say. It is so rare as compared with the Scandinavian occurrence, as he reports it for some localities, that on a genetical basis the Labrador plant would seem to be a case of a sporadic, recessive mutation, rather than due to the segregation of individuals out of a population carrying factors for both white and yellow. This is evidently a case which requires cyto-taxonomic and breeding analysis for an approach to a clarification of the basic phenomena involved.

COCHLEARIA GROENLANDICA L. Between the beach and the slaty talus on the south side of Rowsell Harbor, no. 352 (A & O); moist crevice in rocky hilltop near the harbor, Gready Island, no. 351 (A & H)

[1] Gelting. Meddel. Grønl. ci. no. 2, 87 (1934).

Cardamine bellidifolia L. On the margins of soil polygons on the first peak of Ikordlearsuk Mountain, no. 359 (A); on moist, mossy north face of the ridge south of East Bay, Ikordlearsuk, no. 358 (A & O); scree on the south side of Peak 19, The Four Peaks, Kangalaksiorvik, no. 357 (A); on the lower slopes of "K-2," north side of Komaktorvik, no. 355 (A); on the steep, moist bank of the "K" River, Kangalaksiorvik, no. 354 (A); top of the ridge north of Razorback Harbor, no. 360 (A); on top of Precipice Mountain, north of Komaktorvik Lake, no. 356 (A); on the easterly peak of the Bishop's Mitre, Kaumajet Mountains, no. 361 (A); on top of the westerly peak of the Bishop's Mitre, no. 362 (A); on the margins of soil polygons, upper ridge above the Valley of the Twin Falls, Kaumajet Mountains, no. 353 (A).

Much of the material of this species collected in Labrador in the past has been labelled *C. bellidifolia* L., var. *laxa* Lange (see Meddel. Grønl. iii. 251 (1887)). While most of the specimens collected in the past agree well with the description of the variety in their generally loose habit, less compacted inflorescences, and longer petioles, my material provides various intermediate stages to the typical species, especially the plants from the higher exposed situations. With a graded series dependent primarily on local environmental variations, it does not seem that the variety is worthy of more than the designation of a form.

Draba fladnizensis Wulfen, var. heterotricha (Lindbl.) Ball, *fide* M. L. Fernald. See Fernald, Rhodora, xxxvi. 286 (1934). Moist, mossy northern face of the ridge south of East Bay, Ikordlearsuk, no. 382 (A & O); steep, wet, cold bank of the "K" River, Kangalaksiorvik, no. 375 (A); spur on the southwest side of Mount Tetragona, no. 379 (A); on the lower slopes of "K-2," north side of Komaktorvik, no. 376 (A); top of the ridge north of Razorback Harbor, no. 384 (A); scree slide from the top of Precipice Ridge to Komaktorvik Lake, nos. 380, 381 (A); on slaty talus slope, Rowsell Harbor, no. 373 (A & O); on the west summit of the Bishop's Mitre, Kaumajet Mountains, no. 387 (A); on the eastward side of the east summit of the Bishop's Mitre, no. 386 (A).

D. rupestris R. Br., *fide* M. L. Fernald. See Fernald l. c. 292. Eastward side of the east summit of the Bishop's Mitre, no. 385 (A).

D. crassifolia Graham, *fide* M. L. Fernald. See Fernald l. c. 293. Steep, wet, cold bank of the "K" River, Kangalaksiorvik, no. 374 (A).

D. nivalis Liljebl., *fide* M. L. Fernald. See Fernald l. c. 296. Talus slope on the west side of the Valley of the Bryant Lakes, Kangalaksiorvik, no. 383 (A); spur on the southwest side of Mount Tetragona, nos. 377, 378 (A); margin of soil polygons on upper ridge above the Valley of the Twin Falls, Kaumajet Mountains, no. 372

(A); moist crevice near the top of hill on Rodney Mundy Island, Indian Harbor, no. 369 (A & H).

D. INCANA L., var. CONFUSA (Ehrh.) Liljebl., *fide* M. L. Fernald. See Fernald l. c. 315. At the edge of "The Park," Hopedale, no. 370 (A, H & F).

D. GLABELLA Pursh, *fide* M. L. Fernald. See Fernald l. c. 333. In the Valley of the Twin Falls, Kaumajet Mountains, no. 371 (A).

*ARABIS ARENICOLA (Richards.) Gelert. See Gelert, Bot. Tids., xxi. 287 (1898). Spur on the southwest side of Mount Tetragona, no. 390 (A); lower slopes of "K-2," north side of Komaktorvik, no. 389 (A); easterly slopes of the Bishop's Mitre, no. 391 (A); gully from the lower ridge to the Valley of the Twin Falls, Kaumajet Mountains, no. 388 (A).

Otherwise known from Greenland, the Arctic Archipelago, and various stations on Hudson Bay.

A. ALPINA L. In gully from the lower ridge to the Valley of the Twin Falls, no. 393 (A).

SAXIFRAGA RIVULARIS L. On moist, mossy slope of ridge south of East Bay, Ikordlearsuk, no. 400 (A & O); on the bank of the "K" River, Kangalaksiorvik, no. 397 (A); on top of Precipice Mountain, no. 398 (A); restricted moist, mossy area near the east summit of the Bishop's Mitre, Kaumajet Mountains, no. 399 (A); on the west summit of the Bishop's Mitre, no. 402 (A); lower ridge above the Valley of the Twin Falls, no. 396 (A); in a moist crevice near hilltop, Rodney Mundy Island, Indian Harbor, no. 395 (A & H); moist gravelly spot under a ledge near the harbor, Gready Island, no. 394 (A & F).

S. CERNUA L. See Fernald and Weatherby, RHODORA, xxxiii. 235 (1931). Halfway down the scree on the south side of Peak 19, The Four Peaks, no. 405 (A); on slaty talus slope, Rowsell Harbor, no. 404 (A & O); slope east of the summits of the Bishop's Mitre, Kaumajet Mountains, no. 406 (A); west summit of the Bishop's Mitre, no. 407 (A); gully from the lower ridge to the Valley of the Twin Falls, nos. 403, 426 (A).

S. CESPITOSA L. On the ridge south of East Bay, Ikordlearsuk, no. 413 (A & O); spur on the southwest side of Mount Tetragona, no. 412 (A); on slaty talus slope, Rowsell Harbor, no. 411 (A & O); ridge east of the summits of the Bishop's Mitre, no. 414 (A); gully from the lower ridge to the Valley of the Twin Falls, no. 410 (A).

S. STELLARIS L. Gravelly brook-bottom near the edge of the tundra above the anchorage, Ryan's Bay, no. 415 (A & O).

S. STELLARIS L., var. COMOSA Poir. Moist, mossy slope at the north end of the ridge extending south from East Bay, Ikordlearsuk, no. 416 (A & O).

S. NIVALIS L. Moist, mossy slope on the north end of the ridge extending south from East Bay, Ikordlearsuk, no. 420 (A & O); scree on the south side of Peak 19, The Four Peaks, no. 419 (A); spur on the southwest side of Mount Tetragona, no. 418 (A); upper part of slaty talus slope, Rowsell Harbor, no. 417 (A & O).

S. aizoides L. Moist gully in cliff on the north side of Razorback Harbor, no. 422 (A); mossy spot near waterfall, north side of Nachvak, no. 421 (B).

S. tricuspidata Retz. Moist gully in cliff on the north side of Razorback Harbor, no. 424 (A); upper part of the slaty talus slope, Rowsell Harbor, no. 423 (A & O).

S. Aizoön Jacq. Moist slope by stream entering the north side of Razorback Harbor, no. 428 (A); mossy spot near waterfall north side of Nachvak, no. 429 (B); upper part of slaty talus slope, Rowsell Harbor, no. 427 (A & O).

S. oppositifolia L. On the upper slopes of "K-2," north side of Komaktorvik, no. 432 (A); east slope near the summits of the Bishop's Mitre, Kaumajet Mountains, no. 433 (A); gully from the lower ridge to the Valley of the Twin Falls, no. 430 (A).

S. oppositifolia L., var. albiflora Lange. See Pflanzenreich iv. Fam. 117, Heft. 69, 624. In gully from the lower ridge to the Valley of the Twin Falls, Kaumajet Mountains, no. 431 (A).

Parnassia Kotzebuei Cham. & Schlecht. On slaty talus slope, Rowsell Harbor, no. 437 (A & O); in gully from the lower ridge to the Valley of the Twin Falls, Kaumajet Mountains, no. 435 (A); in the Valley of the Twin Falls, no. 436 (A).

Rubus acaulis Michx. At base of the hill back of the Moravian Mission, Hopedale, no. 455 (A & H).

R. Chamaemorus L.

Noted farthest north along the coast of Labrador at Kikkertaksoak Island, Saglek, August 19. No fruit had set on any of the plants, the single floral pedicels ending instead in the dried remains of the flowers. Delabarre[1] also noted that during the season of 1900 the "bakeapple" had not set fruit where it occurred farthest north on the coast. Holm[2] remarks that *R. Chamaemorus* "seldom becomes sufficiently advanced to produce mature fruit in these [the Polar] regions," although he considers the center of distribution is to be sought there. Why instead is this not a plant which is either working farther north by its highly specialized and efficient means of vegetative reproduction, or else originally was farther north during the "climatic optimum" after the Wisconsin glaciation and is now surviving thanks to its capable vegetative system? Either interpretation would account for the presence of the plant in regions which environmentally are apparently not suited to its reproducing by means of fruit.

[1] Delabarre, Bull. Geogr. Soc. Phila. iii. (1902).

[2] Holm, Rep. Can. Arctic Exp. 1913–18, v. pt. B, 107 (1922).

Potentilla nivea L. In the gully from the lower ridge to the Valley of the Twin Falls, Kaumajet Mountains, no. 440 (A).

P. norvegica L., var. labradorica (Lehm.) Fern. See Fernald, Rhodora, xxviii. 213 (1926). At the edge of "The Park," Hopedale, no. 441 (A, H & F).

*P. emarginata Pursh. See Malte, Rhodora, xxxvi. 173 (1934). Moist, mossy mountain slope on the south side of East Bay, Ikordlearsuk, no. 444 (A & O); bank of "K" River, Kangalaksiorvik, nos. 442, 443 (A).

Otherwise this species is known from Port Burwell, Ungava Bay (*Malte*, 1928, and *Macoun*, 1910), Hudson Bay, Greenland, the Arctic Archipelago and elsewhere in the Arctic, and on the Shickshock Mts. of Gaspé.

P. alpestris Hall f. In mossy meadow beside lake south of East Bay, Ikordlearsuk, no. 449 (A & O); in tundra above the anchorage, Ryan's Bay, no. 450 (A & O); on the banks of "K" River, Kangalaksiorvik, no. 447 (A); near the base of "K-2," north of Komaktorvik, no. 448 (A); on the shore east of the Bishop's Mitre, no. 451 (A); in the Valley of the Twin Falls, no. 446 (A); moist sphagnous tundra, Rodney Mundy Island, Indian Harbor, no. 445 (A & H).

Dryas integrifolia M. Vahl. Ogualik Island, no. 454 (B); on the lower ridge above the Valley of the Twin Falls, no. 453 (A); on disintegrated trap dike near the harbor, Rodney Mundy Island, Indian Harbor, no. 452 (A & H).

Astragalus alpinus L. On upper margin of the beach, Rowsell Harbor, no. 457 (A & O); in the Valley of the Twin Falls, no. 456 (A).

A. eucosmus Robinson. In the Valley of the Twin Falls, Kaumajet Mountains, no. 459 (A); near the harbor, on Rodney Mundy Island, Indian Harbor, no. 458 (A & H).

Otherwise known from the coast at Rama where it was collected by *Stecker* in 1899 and at Nain where it was collected by *Sewall* in 1927.

*Oxytropis foliolosa Hook. For this and the following species see Fernald, Rhodora, xxx. 137 (1928). On the upper margin of the beach, Rowsell Harbor, no. 460 (A & O).

This has been collected elsewhere in eastern North America at Wakeham Bay, Hudson Strait, by *Malte* in 1927 and in Newfoundland by Professor *Fernald* and his companions. In Newfoundland Professor Fernald[1] notes that it is known only from areas with basic rock. The Labrador station is also basic rock, the Rama formation of slates. The species is otherwise known only from the Rocky Mountains.

O. terrae-novae Fernald. On the upper margin of the beach,

[1] Rhodora, xxxv. 274 (1933).

Rowsell Harbor, no. 463 (A & O); on hilltops near the harbor, Rodney Mundy Island, Indian Harbor, no. 462 (A & H); seaward side of hill back of Battle Harbor, no. 461 (A).

Lathyrus japonicus Willd., var. aleuticus (Greene) Fernald. See Fernald, Rhodora, xxxiv. 177 (1932). In cracks of the rock, top of hill near harbor, Rodney Mundy Island, Indian Harbor, no. 465 (A & H); hillsides near harbor, Gready Island, no. 464 (A & H).

Empetrum nigrum L. Tundra near the west shore of the island, Kikkertaksoak, Saglek, no. 466 (A).

Ubiquitous at lower elevations in the tundra.

Viola palustris L. Half way up hill back of the Moravian Mission, Hopedale, no. 467 (A & H).

V. pallens (Banks) Brainerd. In sphagnous meadow beside lake on Gready Island, no. 468 (A & H).

V. labradorica Schrank. In the valley of the Komaktorvik River, no. 471 (A); in the Valley of the Twin Falls, no. 470 (A); moist, sphagnous tundra, Rodney Mundy Island, Indian Harbor, no. 469 (A & H).

Epilobium angustifolium L., var. intermedium (Wormsk.) Fernald. See Fernald, Rhodora, xx. 1 (1918). Moist slope by stream on the north side of Razorback Harbor, no 478 (A).

E. latifolium L. Tundra above the anchorage, Ryan's Bay, no. 479 (A & O).

Very common in northern Labrador and especially well-developed in number of individuals and luxuriance of growth on gravelly outwash plains and deltas.

E. alpinum L. See Fernald, Rhodora, xx. 36 (1918). On the north shore of Kangalaksiorvik, no. 480 (O & F).

Conioselinum chinense (L.) B. S. P. See Fernald, Rhodora, xxviii. 221 (1926). Mossy stream bank near the top of the hill back of Battle Harbor, nos. 481, 609 (A).

Collected previously by Bishop at Frenchman's Run, 1928.

Pyrola secunda L., var. obtusata Turcz. In the Valley of the Twin Falls, Kaumajet Mountains, no. 482 (A).

P. grandiflora Radius. On slaty talus slope, Rowsell Harbor, no. 485 (A & O); in the Valley of the Twin Falls, no. 484 (A); in moist sphagnous tundra, Rodney Mundy Island, Indian Harbor, no. 483 (A & H).

Ledum palustre L., var. decumbens Aiton. Sphagnous meadow, Gready Island, no. 487 (A & F); tundra on Hawkes Island, no. 486 (A).

As Simmons[1] points out, the variety grades into the species proper. It hardly seems that this variety is worth more than the designation of a form, since it seems to be primarily an ecological development.

[1] Simmons, Phytogeogr. Arctic Amer. Arch. 116 (1913).

Rhododendron lapponicum (L.) Wahlenb. In the valley of the Komaktorvik River, no. 488 (A).

Cassiope tetragona (L.) D. Don. On the summit of "K-2," north side of Komaktorvik, no. 494 (A); on slaty talus slope, Rowsell Harbor, no. 493 (A & O).

C. hypnoides (L.) D. Don. West side of the Valley of the Bryant Lakes, no. 492 (A); on the summit of "K-2," north side of Komaktorvik, no. 491 (A); on the bank of the "K" River, no. 490 (A); lower ridge above the Valley of the Twin Falls, Kaumajet Mountains, no. 489 (A).

Vaccinium Vitis-Idaea L., var. minus Lodd. On the summit of "K-2," north side of Komaktorvik, no. 496 (A); on the main ridge above the Valley of the Twin Falls, no. 495 (A).

Statice labradorica (Wallr.) Hubbard & Blake. See Blake, Rhodora, xix. 1 (1917). In the Valley of the Twin Falls, Kaumajet Mountains, no. 498 (A); moist sphagnous tundra, Rodney Mundy Island, Indian Harbor, no. 497 (A & H).

Primula stricta Hornem. For this and the following species see Fernald, Rhodora, xxx. 59 (1928). Moist, gravelly slopes, Near Island (Amiktok), Kangalaksiorvik, no. 501 (A).

P. laurentiana Fernald. Moist sphagnous tundra, Rodney Mundy Island, Indian Harbor, no. 500 (A & H).

P. egaliksensis Wormskj. Cracks in rock hilltops near the harbor, Rodney Mundy Island, Indian Harbor, no. 503 (A & H).

Gentiana nivalis L. In the Valley of the Komaktorvik River, no. 504 (A); moist slope on the north side of Razorback Harbor, no. 505 (A). Also noted on the moist, cold bank of the "K" River but not collected.

A species collected but seldom on the coast of Labrador. Other collections in the Gray Herbarium from this region were made by Delabarre at Saglek Bay in 1900, by Sornborger at Rama in 1897, and by Rev. Heldenburg "in Labradoria" about 1845.

Veronica Wormskjoldii Roem. & Schult. (*V. alpina* L., var. *unalaschensis* C. & S.). See Pennell, Rhodora, xxiii. 15 (1921). Between the beach and the slaty talus, Rowsell Harbor, no. 507 (A & O); in the Valley of the Twin Falls, Kaumajet Mountains, no. 508 (A); moist sphagnous tundra, Rodney Mundy Island, Indian Harbor, no. 506 (A & H).

Castilleja pallida (L.) Spreng., var. septentrionalis (Lindl.) Gray. Tundra above the anchorage, Ryan's Bay, no. 610 (A & O); east shore below the Bishop's Mitre, Kaumajet Mountains, no. 512 (A); Ogualik Island, no. 511 (B); in the Valley of the Twin Falls, no. 510 (A); moist, sphagnous tundra, Rodney Mundy Island, Indian Harbor, no. 509 (A & H).

Euphrasia arctica Lange. See Fernald and Wiegand, Rhodora, xvii. 192 (1915); and also Fernald, Rhodora, xxxv. 301 (1933). Dry, gravelly slopes, Near Island, (Amiktok), Kangalaksiorvik, no. 515 (A); wet bank of stream tributary to the "K" River, Kangalaksiorvik, no. 514 (A); between the beach and the slaty talus, Rowsell Harbor, no. 513 (A & O).

*E. hudsoniana Fern. and Wieg. See Fernald and Wiegand, l. c. 194. Mossy spot near waterfall on the north side of Ryan's Bay, no. 516 (B).

This little-known species was collected by *Spreadborough* on the Koaksoak River, Ungava Bay, in 1896. Otherwise it seems to be unknown from the Labrador peninsula and previously had not been collected from the Atlantic coast.

Bartsia alpina L. Between the beach and the slaty talus, Rowsell Harbor, no. 519 (A & O); in the Valley of the Twin Falls, Kaumajet Mountains, no. 518 (A); moist, sphagnous tundra, Rodney Mundy Island, Indian Harbor, no. 517 (A & H).

Pedicularis lapponica L. On slaty talus slope, Rowsell Harbor, no. 520 (A & O); in the Valley of the Twin Falls, Kaumajet Mountains, no. 612 (A).

P. labradorica Hout. See Fernald, Rhodora, xxxiii. 193 (1931). Near the beach by the old Eskimo village, Hopedale, no. 521 (A & H).

P. flammea L. On slaty talus slope, Rowsell Harbor, no. 523 (A & O); in the Valley of the Twin Falls, Kaumajet Mountains, no. 522 (A).

Pinguicula villosa L. Moist, sphagnous tundra near a small brook, Rodney Mundy Island, Indian Harbor, no. 525 (A & H).

P. vulgaris L. Mossy spot near waterfall on the north side of Nachvak, no. 524 (B).

Plantago juncoides Lam., var. glauca (Hornem.) Fernald. See Fernald, Rhodora, xxvii. 93 (1925). Freshwater pool near harbor, Gready Island, no. 527 (A & H).

Lonicera villosa (Michx.) R. & S., var. calvescens (Fern. & Wieg.) Fernald. (*L. caerulea* L., var. *calvescens* Fern. & Wieg.). See Fernald, Rhodora, xxvii. 8 (1925). In moist, sphagnous tundra near small brook, Rodney Mundy Island, Indian Harbor, no. 528 (A & H).

Linnaea borealis L., var. americana (Forbes) Rehder. Margin of spruce-fir grove, Kikkivitak Island, Ittekaut Bay, no. 529 (A).

Campanula uniflora L. In the Valley of the Twin Falls, Kaumajet Mountains, no. 476 (A); side of a gravelly hill on Rodney Mundy Island, Indian Harbor, no. 475 (A & O).

The collection from the Valley of the Twin Falls has the corolla markedly shorter than the calyx-lobes which gives it a distinctive appearance. An examination of the material in the Gray Herbarium indicates, however, that it is merely a very extreme form connected by intermediates with the more usual type, which also varies to the other extreme where the corolla is much longer than the calyx.

C. ROTUNDIFOLIA L. See Malte, RHODORA, xxxvi. 188 (1934). Among rocks in the delta of the "K" River, Kangalaksiorvik, no. 473 (A); top of the ridge north of Razorback Harbor, no. 474 (A); moist sphagnous tundra, Rodney Mundy Island, Indian Harbor, no. 472 (A & H).

SOLIDAGO MACROPHYLLA Pursh, var. THYRSOIDEA (E. Meyer) Fernald. See Fernald, RHODORA, viii. 227 (1906). Mossy spot near waterfall on the north side of Nachvak, no. 531 (B); between the hill and the beach near the old Eskimo village, Hopedale, no. 530 (A & H).

S. MULTIRADIATA Ait. See Fernald, RHODORA, xvii. 4 (1915). Moist gully in cliff on the north side of Razorback Harbor, no. 535 (A); on slaty talus slope, Rowsell Harbor, no. 534 (A & O); Ogualik Island, no. 536 (B); in the Valley of the Twin Falls, no. 533 (A).

ERIGERON UNALASCHENSIS (D. C.) Vierh. See Malte, RHODORA, xxxvi. 190 (1934). On slaty talus slope, Rowsell Harbor, no. 537 (A & O); just below the easterly summit of the Bishop's Mitre, Kaumajet Mountains, no. 538 (A).

ANTENNARIA HUDSONICA Malte, *fide* M. O. Malte. For a consideration of this and the following species see Malte, RHODORA, xxxvi. 101 (1934). On the ridge south of East Bay, Ikordlearsuk, no. 547 (A & O); dry gravelly slopes of Near Island (Amiktok), Kangalaksiorvik, no. 549 (A).

A. CANESCENS (Lange) Malte, *fide* M. O. Malte. Dry gravelly slopes of Near Island (Amiktok), Kangalaksiorvik, no. 554 (A); steep, wet, cold bank of the "K" River, Kangalaksiorvik, nos. 552, 553 (A); moist gully in cliff on the north side of Razorback Harbor, nos. 556, 556a (A).

A. LABRADORICA Nutt., *fide* M. O. Malte. See Fernald, RHODORA, xxxiii. 222 (1931). Near the top of Precipice Mountain, Torngat Mountains, no. 543 (A)—identity doubtful; in the Valley of the Twin Falls, Kaumajet Mountains, no. 550 (A).

A. ANGUSTATA Greene, *fide* M. O. Malte. Scree on the south side of Peak 19, The Four Peaks, nos. 545, 545a (A); dry gravelly slopes, Near Island (Amiktok), Kangalaksiorvik, no. 546 (A); small spur on the southwest side of Mount Tetragona, no. 542 (A); summit of "K-2," north side of Komaktorvik, nos. 541, 541a (A); steep, wet, cold bank of the "K" River, Kangalaksiorvik, nos. 540, 540a (A); top of the ridge north of the harbor, Razorback Harbor, no. 548 (A); scree slide from the top of Precipice Ridge to Komaktorvik Lake, no. 544 (A); on slaty talus slope, Rowsell Harbor, no. 539 (A & O).

A. PYGMAEA Fernald. See Fernald, RHODORA, xvi. 129 (1914) and RHODORA, xxvi. 99 (1924). Base of "K-2," north side of Komaktorvik, no. 561 (A); steep, wet, cold bank of the "K" River, Kangalaksiorvik, no. 560 (A); on slaty talus slope, Rowsell Harbor, no. 559 (A & O); Valley of the Twin Falls, Kaumajet Mountains, no. 558 (A).

A. isolepis Greene. Dry hillside, west shore of the island, Kikkertaksoak, Saglek, no. 562 (A).

A. sp. unidentifiable, *fide* M. O. Malte. Moist gully in cliff on the north side of Razorback Harbor, no. 555 (A); on slaty talus slope, Rowsell Harbor, no. 551 (A & O).

Gnaphalium supinum L. Half way down the scree on the south side of Peak 19, The Four Peaks, no. 564 (A); scree slide from the top of Precipice Ridge to Komaktorvik Lake, no. 563 (A).

The only other collection from the coast of Labrador is that made by *Sornborger* at Rama in 1897.

Artemisia borealis Pall. Valley of the Komaktorvik River, no. 566 (A); on slaty talus slope, Rowsell Harbor, no. 565 (A & O).

A. borealis Pall., var. latisecta Fernald. See Fernald, Rhodora, xxix. 93 (1927). Dry, gravelly slopes, Near Island (Amiktok), Kangalakasiorvik, no. 567 (A).

Arnica terrae-novae Fernald. See Fernald, Rhodora, xxxv. 365 (1933). Moist, meadowy hillsides, Near Island (Amiktok), Kangalaksiorvik, no. 572 (A); moist gully in cliff on the north side of Razorback Harbor, no. 573 (A); slaty talus slope, Rowsell Harbor, nos. 570, 571 (A & O).

A. plantaginea Pursh. See Fernald, Rhodora, xxvi. 104 (1924). On slaty talus slope, Rowsell Harbor, no. 569 (A & O); moist, sphagnous tundra, Rodney Mundy Island, Indian Harbor, no. 568 (A & H).

Senecio pauciflorus Pursh. See Fernald, Rhodora, xxvi. 116 (1924). Valley of the Komaktorvik River, no. 575 (A); Valley of the Twin Falls, Kaumajet Mountains, no. 574 (A).

S. palustris (L.) Hook. Moist bottom of a recently desiccated pool on the seaward side of the island, Battle Harbor, no. 576.

Immature specimens, kindly determined by Professor Fernald.

Taraxacum lacerum Greene, *fide* M. L. Fernald. See Fernald, Rhodora, xxxv. 378 (1933). Lakeside meadow at foot of ridge south of East Bay, Ikordlearsuk, nos. 593, 594 (A & O); moist, meadowy hillsides, Near Island (Amiktok), Kangalaksiorvik, no. 595 (A); top of ridge north of harbor, Razorback Harbor, no. 596 (A); moist gully in cliff on north side of Razorback Harbor, nos. 583, 597 (A); base of hill back of Moravian Mission, Hopedale, no. 592 (A & H).

T. lapponicum Kihlm., *fide* M. L. Fernald. See Fernald, l. c. 383. Shore of lake at base of hill south of East Bay, Ikordlearsuk, no. 585 (A & O); moist hillside above tundra near the anchorage, Ryan's Bay, nos. 588, 589 (A & O); dry, gravelly slopes, Near Island (Amiktok), Kangalaksiorvik, no. 591 (A); base of "K-2," near "K" River, no. 578 (A); moist gully in cliff on north side of Razorback Harbor, nos. 582, 584, 590 (A); moist crevice in hillside near harbor, Rodney Mundy Island, Indian Harbor, no. 598 (A & H).

T. sp. (unidentifiable) *fide* M. L. Fernald. Valley of the Komaktorvik River, no. 587 (A); Ogualik Island, nos. 586, 586a (B); Valley of the Twin Falls, Kaumajet Mountains, no. 581 (A); base of the hill back of the Moravian Mission, Hopedale, nos. 579, 580 (A & H).

Crepis nana Richards. On the lower ridge above the Valley of the Twin Falls, Kaumajet Mountains, no. 599 (A).

This collection is a single individual of a very rare species. It was growing in the exceedingly well-drained gravel formed by the decomposition of the basic rocks of the Mugford series. Although an extensive search was made for other individuals, none were found. It is of interest that it is also very rare and local in Newfoundland as Professor Fernald[1] indicates in his dramatic description of its discovery on the dry limestone barrens of Burnt Cape. The only other records in eastern North America for this rarity are from Rama on the coast of Labrador where it was collected in 1897 by *Sornborger*, and in 1899 by *Stecker*, from an outcrop of slate.[2] There is still another record of a very ambiguous nature in the Gray Herbarium. A single plant of *Crepis nana* has associated with it a label which indicates that it was collected by "Waitz" at "O. Kuk," Labrador and also by "Wietz" at Northumberland Bay. Under the circumstances this specimen with its dual data can hardly be considered. As far as we have good records this interesting little plant appears to occur only on areas of basic rock in eastern North America.

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INDEX

Agrostis borealis, 122, 124, 140.
Alnus crispa, 148; fruticosa, 135.
Alopecurus aequalis, var. natans, 140.
Androsace septentrionalis, 134.
Anemone parviflora, 150
Antennaria, 109, 126, 160; alpina, 122; angustata, 115, 116, 120, 125, 159; burwellensis, 126; canescens, 125, 159; congesta, 126; hudsonica, 115, 120, 159; isolepis, 160; labradorica, 120, 159; pygmaea, 126, 159; Sornborgeri, 126.
Arabis alpina, 125, 153; arenicola, 119, 125, 153.
Arenaria cylindrocarpa, 123, 150; groenlandica, 150; humifusa, 123, 126, 131, 150; sajanensis, 113, 118, 124, 150; verna, var. pubescens, 119, 124, 149, f. epilis, 149.
Arnica, 109, 126; plantaginea, 160; Sornborgeri, 126; terrae-novae, 125, 160.
Artemisia borealis, 160, var. latisecta, 160.
Aster foliaceus, var. frondeus, 126.
Astragalus alpinus, 155; eucosmus, 155.
Bartsia alpina, 158.
Betula alba, 135; glandulosa, 148.
Calamagrostis canadensis, var. robusta, 140; neglecta, 140, var. borealis, 140.
Campanula rotundifolia, 120, 159; uniflora, 158.
Cardamine bellidifolia, 112–114, 116, 119, 122, 125, 152, var. laxa, 152.
Carex, 109; alpina, 144; aquatilis, 145; bipartita, 124, 144; canescens, 144; capillaris, 118, 144; capitata, 143; concolor, 118, 122, 144; filifolia, 123, 126, 131; glareosa, 134, 144; incurva, 134, 143; Lachenalii, 144; maritima, 143; membranopacta, 145; microglochin, 145; misandra, 113, 118, 144; paupercula, 144; rariflora, 144; rigida, 122, 144; saxatilis, var. rhomalea, 145; scirpoidea, 116, 124, 144; subspathacea, 145; Vahlii, 144.
Cassiope hypnoides, 115, 116, 120–122, 157; tetragona, 116, 157.
Castilleja pallida, var. septentrionalis, 157.
Cerastium alpinum, 117, 121, 134, 149, var. glanduliferum, 114, 119, 149, var. lanatum, 119, 149; arvense, 149; Beeringianum, 123, 124, 126, 131, 149; cerastioides, 124, 149.
Cochlearia groenlandica, 151.
Conioselinum chinense, 156.
Corallorrhiza trifida, 146.
Crepis nana, 120, 126, 161.
Cystopteris fragilis, 124, 139.
Danthonia intermedia, 126
Deschampsia alpina, 140; atropurpurea, 141; flexuosa, 140, var. montana, 141.
Draba, 109; crassifolia, 152; fladnitzensis, 117; fladnizensis, var. heterotricha, 116, 119, 125, 152; glabella, 153; incana, var. confusa, 153; nivalis, 113, 119, 125, 134, 152; rupestris, 119, 152; Sornborgeri, 123, 126; stenoloba, 123.
Dryas integrifolia, 120, 155.
Dupontia psilosantha, 142.
Elymus arenarius, 143.
Empetrum, 121; nigrum, 156.
Epilobium alpinum, 156; angustifolium, var. intermedium, 156; Drummondii, 126, 131; latifolium, 156.
Equisetum sylvaticum, var. pauciramosum, 139.
Erigeron unalaschensis, 159.
Eriophorum angustifolium, 143; Scheuchzeri, 134, 143; spissum, 143.
Euphrasia arctica, 157; hudsoniana, 158.
Festuca brachyphylla, 116, 118, 124, 134, 142, 143; brevifolia, 142; rubra, 142; supina, 142; vivipara, 143.
Gentiana nivalis, 157.
Gnaphalium supinum, 125, 160.
Gramineae, 109.
Habenaria dilatata, 146; obtusata, var. collectanea, 146.
Hierochloë, 121; alpina, 112, 116, 118, 134, 139; odorata, 139.
Juncus albescens, 134, 146; biglumis, 146; castaneus, 146; filiformis, 146; trifidus, 122, 146.
Juniperus communis, var. montana, 139.
Kobresia Bellardi, 143.

Koenigia islandica, 148, 150.
Larch, 112.
Lathyrus japonicus, var. aleuticus, 156.
Ledum palustre, var. decumbens, 156.
Lichens, 112, 116, 133.
Linnaea borealis, var. americana, 158.
Lonicera caerulea, var. calvescens, 158; villosa, var. calvescens, 158.
Luzula campestris, var. frigida, 124, 146; confusa, 112, 114, 116–118, 121, 122, 134, 145; parviflora, 145; spicata, 116, 118, 121, 122, 124, 145.
Lychnis alpina, 124, 148; affinis, 148; furcata, 119, 124, 148.
Lycopodium, 139; alpinum, 139; Selago, 122, var. appressum, 116, 118, 139.
Montia lamprosperma, 150.
Mosses, 112, 116.
Myrica Gale, 148.
Oxyria, 121; digyna, 114, 119, 124, 134, 148.
Oxytropis foliolosa, 155; terrae-novae, 155.
Papaver nudicaule, 117; radicatum, 113, 114, 116, 119, 121, 151.
Parnassia Kotzebuei, 125, 154
Pedicularis flammea, 158; groenlandica, 123, 126; labradorica, 158; lapponica, 158.
Petasites sagittata, 123, 126.
Phippsia algida, 118, 121, 140.
Pinguicula villosa, 158; vulgaris, 158.
Plantago juncoides, var. glauca, 158.
Poa alpigena, 124, 141; alpina, 118, 141, var. brevifolia, 141; arctica, 116, 121, 141; glauca, 114, 116, 118, 121, 124, 141; labradorica, 126; rigens, 141.
Polygonum, 121; viviparum, 148.
Polystichum Lonchitis, 139.
Potentilla alpestris, 155; emarginata, 121, 125, 155; nivea, 125, 155; norvegica, var. labradorica, 155.
Primula egaliksensis, 157; laurentiana, 157; stricta, 157.
Puccinellia phryganodes, 142.
Pyrola grandiflora, 156; secunda, var. obtusata, 156.
Ranunculus affinis, 151; Allenii, 151; glacialis, 121; nivalis, 124, 150; pedatifidus, var. leiocarpus, 151; pygmaeus, 114, 119, 150; reptans, 150; trichophyllus, var. eradicatus, 150.
Rhododendron lapponicum, 157.
Rubus acaulis, 154; Chamaemorus, 154.
Sagina nivalis, 113, 119, 150.
Salix, 109; anglorum, 119, 147, var. araioclada, 124, 147, var. kophophylla, 147; arctophila, 147; arctophila × glauca, 121; argyrocarpa, 148; calcicola, 148; cordifolia, var. callicarpaea, 147, var. intonsa, 147, var. Macounii, 148, var. typica, 147; herbacea, 113, 118, 121, 122, 147; planifolia, 148; reticulata, 146; Uva-ursi, 113, 118, 147; vestita, 118, 146.
Saxifraga aizoides, 125, 154; Aizoon, 154; cernua, 116, 120, 125, 153; cespitosa, 117, 120, 125, 153; nivalis, 117, 120, 125, 153; oppositifolia, 120, 121, 125, 134, 154, var. albiflora, 154; rivularis, 114, 116, 117, 120, 121, 125, 153; stellaris, 153, var. comosa, 125. 153; tricuspidata, 125, 154.
Scirpus cespitosus, var. callosus, 143.
Sedum, 117.
Selaginella selaginoides, 139.
Senecio palustris, 160; pauciflorus, 126, 131, 160.
Silene acaulis, 121, 122, var. exscapa, 119, 134, 148.
Smilacina trifolia, 146.
Solidago macrophylla, var. thyrsoidea, 159; multiradiata, 125, 126, 159.
Sparganium hyperboreum, 139.
Spruce, 112.
Statice labradorica, 157.
Stellaria crassifolia, 149; humifusa, 149; longipes, 149.
Taraxacum, 109, 126, 160; lacerum, 120, 125, 126, 160; lapponicum, 125, 160; torngatense, 126.
Tofieldia minima, 124, 146; palustris, 146.
Triglochin palustris, 139.
Trisetum spicatum, 141, var. Maidenii, 118, 124, 141, var. pilosiglume, 124, 141.
Vaccinium, 121; Vitis-Idaea, var. minus, 113, 116, 120, 157.
Veronica alpina, var. unalaschensis, 157; Wormskjoldii, 157.
Viola labradorica, 156; pallens, 156; palustris, 156.
Woodsia glabella, 124, 134, 139; ilvensis, 124, 138.

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No. CXII

A Study of the Nolanaceae

By Ivan M. Johnston

A STUDY OF THE NOLANACEAE

By Ivan M. Johnston

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The Nolanaceae are a very natural group of more or less succulent herbs and small shrubs characteristic of the coastal districts of northern Chile and southern Peru. They are evidently related to the Solanaceae from which they differ in the nature and structures of their remarkable fruit. This bony fruit, basically pentamerous, is schizocarpic or consists of three to numerous one- to eight-seeded nutlets that are uniseriate or pluriseriate in superimposed series. The last complete enumeration of the species was by Dunal in 1852, who (treating the group as a subtribe of the Solanaceae) recognized 33 species distributed among 5 genera. This work was prepared, however, when the coastal deserts of northern Chile and southern Peru, which we now know to contain the majority of the Nolanaceae, were almost unknown botanically. It was not until the publication of the extensive but unorganized and overly enthusiastic work of Philippi, between 1860 and 1895, that the variety and number of the Chilean species were appreciated. The Peruvian species have remained very imperfectly known. Until recently very little concerning them had been added to the few observations made by Ruiz and Pavon in 1799.

Only three families, the Boraginaceae, Convolvulaceae and Solanaceae, have been suggested as possible relatives of the Nolanaceae. The possibility of direct relation between the Nolanaceae and the Boraginaceae needs no serious consideration, for it is based upon the most superficial of resemblances in the fruiting structures. The closest relations are evidently with the Solanaceae. This affinity, emphasized by such workers as Miers, Dunal, Eichler, Baillon, Solereder, Wettstein and Hallier, is shown by agreements between the families in a host of minor and major details of anatomy and morphology involving all parts of the plant. On the other hand, in the general appearance of the corollas of some Nolanaceae and in the pentamerous nature of the fruit, Endlicher, Bentham and Hooker, and recently, Hutchinson, have not only seen evidences of relationship with the Convolvulaceae but reasons actually for subordinating our family under it. It is necessary, therefore, to discuss these characters of the corolla and fruit of the Nolanaceae which have been taken as indicative of a close relationship with the Convolvulaceae, to interpret them and to balance them against the similarities in anatomy, secretions, indument, sympody, recaulescence, gamosepaly, sepal-aestivation, gross habit, etc., etc., which have been emphasized by those who see the Nolanaceae as related to the Solanaceae.

The corollas of the Nolanaceae are plicate, regularly and somewhat cochleately so, and in aestivation, therefore, stand about equally close to conditions observable in both Solanaceae and Convolvulaceae. The large blue corollas of some Nolanaceae, and especially those that have reached European gardens, superficially suggest those of some Convolvulaceae. However, these also resemble the corollas of such genera of the Solanaceae as *Petunia* and, what is more, the small corollas of the shrubby species of *Nolana,* which are very different from any in the Convolvulaceae, are very much like those of *Fabiana, Lycium,* etc. of the Solanaceae. In fact the corollas of the Nolanaceae, in appearance, size, form, color and texture, evidently fall well within the range of corolla-variation exhibited by the South American Solanaceae. The corollas of most Nolanaceae, on the other hand, are quite different in appearance from any observable in the Convolvulaceae. The flowers of the Nolanaceae, furthermore, show tendencies toward zygomorphy, as evidenced by the more or less unequal calyx-lobes, the occasionally cleft calyx, the constantly unequal (3 long and 2 short) stamens, and the occasional obscurely 2-lipped corollas. These are familiar features in the Solanaceae but not in the Convolvulaceae. Indeed, a careful study of the corolla and stamens throughout the Nolanaceae, far from revealing structures and conditions indicative of the relations of the family in the Convolvulaceae, actually make that supposed affinity seem more improbable and the relationship with the Solanaceae, suggested by similarities in the calyx, inflorescence and vegetative parts, seem so very probable as to approach certainty.

The ovary in the Nolanaceae is pentamerous. This is the common (though not the universal) condition in the Convolvulaceae. Upon the fact of this agreement between the Nolanaceae and the Convolvulaceae, those who argue for the supposed immediate relation between these two families, must make their stand. In the Solanaceae the ovary is prevailingly dimerous, the notable single exception being the 5-celled baccate fruit of the Peruvian *Nicandra.* However, since with the best of reasons the Tetracyclicae are all assumed to have had ancestory with a pentamerous ovary, the pentamery of the ovary in the Nolanaceae may well be considered as the persistence of a generally primitive condition or as a reversion to it. This reasoning is accepted in retaining *Nicandra* in the Solanaceae. Hence, I can not feel that this pentamery in the Nolanaceae must necessarily indicate relationship in the Convolvulaceae, nor that it is a bar to direct relations in the Solanaceae.

Some importance has been placed on the fact that the ovules of the Nolanaceae and Convolvulaceae agree in their basal attachment and thus differ from those of the Solanaceae which are axial. In reply to this it must be noted, however, that in the number of ovules and in the structure of the embryo the Nolanaceae agree much more closely with the Solanaceae. Furthermore their basal attachment may well be the direct, we may even add, the inevitable, result of evolutionary changes that have ended in the development of the nutlet-type of fruit in the Nolanaceae.

The fruit of the Nolanaceae has developed, I believe, from a many-seeded berry in which the carpial and placental tissue has become united and hardened into a bony mass and lobed into nutlets each containing one or more embedded seeds. The most primitive fruit is that of *Alona* where the style is terminal and seated in the pericarp and the parts of the schizocarp are typically several- to many-seeded and broadly joined to the receptacle and to one another into a rounded mass. In *Nolana* the fruit becomes lobed, the style becomes attached to the receptacle, and the nutlets become free from one another. In its simple form, as in *N. humifusa*, the fruit of *Nolana* is composed of 5, large, several-seeded, crowded, angular nutlets which are broadly attached to the receptacle. In the shrubby species of *Nolana*, on the other hand, the fruit is reduced to 5, well spaced, globose or ovoid, basally attached, single-seeded nutlets. In such herbaceous species of *Nolana*, as *N. paradoxa*, *N. baccata* and *N. Gayana*, the nutlets exhibit another kind of simplification. Here the nutlets of the type of *N. humifusa* have undergone tangential lobing. One or more seeds have been cut off from the broad multispermous mass of the original nutlet and 2 or more concentric ranks of small, few-seeded nutlets formed.

The remarkable fact about the Nolanaceous fruit is the number and scattered arrangement of the seeds, each in a special cavity and each directly attached to the receptacle, that may be present in each of the nutlets. This is particularly evident in the schizocarpic fruit of *Alona*, which, as indicated, is primitive in its terminal style and its rounded unlobed fruit with continuous pericarp. It seems evident that fruit of the Nolanaceae must have developed from a multispermous berry, which became sclerified and schizocarpic and finally lobed. Accompanying this the axial placenta became reduced and finally receptacular. Certainly it could not have had a drupaceous origin as have had the fruits of the Boraginaceae, Verbenaceae and Labiatae. Nor can it have developed from the fruit of the Convolvulaceae which is prevailingly dry and capsular, with false septa, biovulate carpels, large seeds, and broad folded cotyledons. The more I have observed and considered the fruit of the Nolanaceae, the stronger has become my belief that it must be a specialized derivative of the multispermous Solanaceous berry.

The Convolvulaceae of southern and western South America are all of the conventional type and do not have the habit nor any peculiar characters suggestive of the Nolanaceae. On the other hand, in and about the very region in which the Nolanaceae abound there is a great display of the Solanaceae, of the most diverse types, many of them with berries and suggestive of the Nolanaceae in a wealth of uncommon floral and vegetative details. In fruit, particularly, these Solanaceae show several significant developments. There are the dry berries in genera such as *Phrodus*. There are various degrees of sclerification observable in the baccate fruits of *Lycium* and *Grabowskia*. And most interestingly there is the berry of *Nicandra*, the one example of pentamerous fruit in the Solanaceae. These modifications of the typical Solanaceous berry are suggestive of a possible combination of tendencies that could have produced the Nolanaceous fruit. Significantly they occur in species from within an area that not only constitutes a great evolutionary center of the Solanaceae, but one which geographically embraces the range of the Nolanaceae as well. The fruit of the Nolanaceae, in agreement with all floral and vegetative characters, is not indicative of affinity with the Convolvulaceae, but is indicative, rather, of a direct origin in the Solanaceae.

Among those who have seriously considered the relationship of the Nolanaceae, within the past half century, Hutchinson alone has placed the relations of the family outside the Solanaceae. Hutchinson followed Bentham and Hooker in treating our family as a part of the Convolvulaceae but gave no reasons for so doing. However, when the relationships of the Nolanaceae have been discussed by special students of the Convolvulaceae (Hallier) or the Solanaceae (Miers, Dunal and Wettstein), these particularly qualified men have uniformly insisted on the close relationship between the Solanaceae and Nolanaceae. Hallier, Bot. Jahrb. **16**: 561 (1893), after a detailed systematic and morphological study of the Convolvulaceae, was most positive in his exclusion of the Nolanaceae from any direct relation with the Convolvulaceae. According to him the relations of our family are clearly with the Solanaceae, just as stated by the monographers of that latter family. With this I fully agree. My study of the Nolanaceae has convinced me that they are evidently related to the Solanaceae and are an extreme product of that evolutionary activity in the Solanaceae which has produced the multiplicity of genera and species of that family in western and southern South America. The relationships are so close that the Nolanaceae might even be treated as a well marked group subordinate to the Solanaceae.

The Nolanaceae are practically confined to the coastal regions of northern Chile and southern Peru, between the ports of Valparaiso and Lima. In the Valparaiso region there are four species, *N. rupicola, N. paradoxa, N. crassulifolia* and *N. sedifolia.* To the south of this region only one species is present, the littoral *N. paradoxa,* which reaches Chilean Patagonia and sets the extreme southern limit of the family in lat. 45° S. North of the region about Valparaiso the species rapidly increase in number in the provinces of Coquimbo (10 spp.), Atacama (19 spp.) and Antofagasta (22 spp.). The provinces of Atacama and Antofagasta together have 28 of the total 63 species of the entire family and so constitute the larger of the two principal centers of the Nolanaceae. Tarapacá, the province of Chile north of Antofagasta, has only 5 species (3 of these endemic) all obviously related to the southward. As is well known, the coastal flora of western South America changes very abruptly near the Chile-Peruvian boundary. This is evident in our family. Of all its numerous species on the Chilean littoral only *N. Jaffuelii* extends into Peru. The three southernmost departments of Peru have the second important center of the Nolanaceae. These departments have a total of 18 species of which 6 occur in Tacna, 2 in Moquegua and 12 in Arequipa. All of these departments, and particularly Moquegua, are in great need of further botanizing. From them will come most of the future additions to the family. North of the department of Arequipa the number of species again decreases. In the poorly explored department of Ica there are 2 known species, *N. Weberbaueri* and *N. insularis.* There are 4 species (*N. humifusa, N. Gayana, N. inflata* and *N. laxa*) known from the department of Lima. The northern limit of the family on the continent is set by *N. humifusa,* in lat. 11° 30′ S., on the coast a few kilometers north of Lima and by *N. laxa,* in lat. 11° 20′ S., in the interior at Canta to the northeast of Lima. The outlying *N. galapagensis,* of the southern Galapagos Islands, sets the extreme northern limit for the family just south of the Equator.

Generally speaking the species of Nolanaceae tend to be of restricted distribution. Many are apparently local and most of the remainder range along less than 500 km. of coast. The few exceptions are *N. paradoxa* (over a 1000 km.), *N. sedifolia* (over a 1000 km.), *N. acuminata* (nearly a 1000 km.) and *N. rupicola* (nearly 800 km.). Of these exceptions, the first two seem to be homogeneous species. *Nolana acuminata* and *N. rupicola,* however, are polymorphous and not well understood. They will probably prove to consist of a number of critical forms of limited distribution.

The Nolanaceae are plants of well drained sands and gravels. The great majority of species occur at low altitudes, well below 1000 m. alt., and well within 75 km. of the coast, and many of them on coastal plains or slopes within sight of the ocean. Only a few species, however, seem to affect the rocky shores or beaches under the direct influence of ocean spray. These littoral plants, *N. paradoxa, N. thinophila, N. crassulifolia, N. galapagensis* and possibly *Alona carnosa,* show the only halophytic tendencies in the family. Contrary to statements found in various books this is not a family of halophytes. It is one of the most characteristic elements of that remarkable vernal vegetation of western Peru and northern Chile, the Loma Formation, which owes its existence to the beneficent effects of the sea-fogs that drift landward during the spring months and bring a little moisture and humidity to this nearly rainless region. Only a few Nolanaceae seem to occur beyond the direct influence of the coastal fogs. *Nolana villosa* grows on the parched crests of the coastal hills above the level of fogs and in the very arid regions behind the coastal hills impassable to them. *Nolana leptophylla* also occurs on the hot dry crests of the coastal hills above the fog and at altitudes between 1000 and 3000 meters along the base of the cordilleras 50–125 km. inland. *Nolana tarapacana* and *N. foliosa* occur about 100 km. inland, the former at 1400 m. alt. and the latter above 2000 m. alt. Unique is the case of *N. flaccida* which extends from the coastal plain at sea-level, inland 125 km. to around 3000 m. alt., from within the fog-belt to well beyond it.

In Peru, as in Chile, most of the Nolanaceae occur near the coast but in the southern departments, where there are only low coastal hills or simply a rolling sweeping ascent towards the cordilleras, the fogs tend to have their maximum effects further inland. Here we have *N. confinis* 30–125 km. inland and at 500 to 4000 m. alt., *N. platyphylla* 50 km. inland and at about 1500 m. alt., and *N. gracillima* 20–60 km. inland and between 600 and 2000 m. alt. Further north in Peru two species occur, not in the well developed Loma Formation of the coastal hills, but beyond these hills and an intervening desert in a belt of spring rains along the base of the cordilleras. These species, *N. laxa* and *N. Weberbaueri*, one to the northeast and the other to the southeast of Lima, occur nearly 100 km. inland at altitudes between 1000 and 1500 meters. As in Chile, however, most of the species in Peru range in the region along the coast and at low altitudes.

It is to be noted that no species are reported from Bolivia. There are a few references and the labels of some specimens that might indicate the presence of the Nolanaceae within that country, but these, I believe, are either incorrect or date from the period when Tarapacá, now Chilean, was a part of Bolivia. Recently a member of the Nolanaceae has been reported from Argentina by Molfino, Physis 8: 117–118 (1925). The record is based upon a flowering specimen from a saline lake in the territory of Los Andes that was thought to suggest "*Dolia clavata*" and "*D. divaricata.*" The saline habitat of the plant, the high altitudes of Los Andes, and the lack of fruiting structures make me doubt this record. I suspect it is based, either upon mislabeled specimens, or upon misleading incomplete material of some other family, probably Solanaceae, incorrectly identified.

As in many other natural families, the species of Nolanaceae offer a perplexing problem in generic classification. They are, generally speaking, readily recognized and defined. Evident differences in habit, indument, glandularity, leaf-shape, flower-size, fruit-structure, etc., permit the ready recognition of most of them upon gross aspect alone. They occupy natural, though generally limited ranges and have their relatives present in adjacent or somewhat distant areas along the coast. Though these species are surprisingly diverse and well marked they do not fall into any groupings that are convincingly natural and monophyletic. The relationships within the family seem to interlock in a confused reticular system. Diverse types of habit, various types of corolla, numerous modifications of the fruit, etc., are associated in a great variety of combinations suggestive of the interlacing relationship. This is particularly evident in several of the striking developments, such as the cleft calyx or the complex stellate or dendritic hairs. These developments appearing only in a highly elaborated form and erratically through the family, have evolutionary lines, as evidenced by a morphological series of increasing complexity, which show little tendency to parallel those of the other structures on the plant.

Early in the course of the work on the Nolanaceae it became clear that though the species could be readily defined and recognized, the natural groups of them were singularly ill-defined and elusive. This paper was left uncompleted for over a year and a half after an unsatisfactory first struggle with the generic problem. I have since returned to that problem at various times and have not only seriously considered placing all the species of the Nolanaceae into a single genus, but also of distributing them into many genera as well. I am finally of the belief that unless one wishes to sponsor a disproportionate number of not overly convincing monotypic or ditypic genera and even submit to the fair challenge of being artificial also, one must either place all the Nolanaceae into the single genus, *Nolana,* or divide the species very unequally between *Nolana* and *Alona* on what seems to be a decisive and fundamental structure of fruit alone.

The genus *Alona* is distinguished from *Nolana* only by characters of fruit. With much justification it could be treated as merely a section or subgenus of *Nolana.* However, since the Nolanaceae represent a departure from the Solanaceae in which a special type of fruit has developed and since the schizocarpic fruit of *Alona* seems evidently less evolved than the nutlet-fruit of *Nolana,* the differences between the two genera, involving structures that justify the very recognition of the family, seem to be important enough, especially since they are clear-cut and decisive, to warrant the use of them in generic separation. Except for the fruit, however, there are no other differences between the two genera. All species of *Alona* are shrubs with narrow leaves. Most of them are glabrous with a rather glutinous or resinous epidermis. In this they are approximated most closely by *Nolana thinophila.* Two of the species are glandular pubescent and not at all resinous. Among the species of *Nolana,* two species, *N. flaccida* and *N. mollis,* much suggest *Alona* in general appearance and flowers.

The genus *Nolana* contains 57 of the total 63 recognized species of the Nolanaceae. For the 57 species there has been published 14 genera typified by 11 different species. Most of these genera, however, were published when only a fraction of the number of species now recognized was known.

The fruit of *Nolana,* differing from *Alona,* consists of distinct, free nutlets, and from species to species exhibits a completely intergrading series of remarkable elaborations. Though several of the extremes in fruit development are so very striking that it is not at all surprising that genera have been based upon them, a study of the fruits of all the species reveals so very many transitional types that the use of fruit in dividing *Nolana* seems thoroughly unwise, especially since gross appearance, habit, corollas, foliage, indument, etc., seem to vary quite independently of it. After many vain attempts to break up *Nolana* into what I would care to sponsor as natural genera, I am convinced that segregation of the genus is possible only if done in an arbitrary and artificial manner.

When I began this study, like many students in the past, I believed that the shrubby species of this group, called "*Dolia*" by the older authors (*Bargemontia*, however, is the prior name), could be recognized. Reluctantly, however, I have been forced to abandon this concept. The character most emphasized by the sponsors of "*Dolia*" has been the shrubby habit which is thought to set it off from the restricted *Nolana* and from the other segregates of *Nolana* such as *Sorema*. The primary habit-characters of "*Dolia*" have been supplemented by others and we find the genus characterized as shrubby plants with small narrow leaves, small flowers, and about 5 one- to few-seeded, ovoid or ellipsoid, well spaced, distinct, uniseriate nutlets. These characters, however, do not vary together. *Nolana galapagensis* is indistinguishable from many species of "*Dolia*" in habit and corolla, but is utterly different in the numerous pluriseriate nutlets. *Nolana aplocaryoides, N. gracillima,* and *N. laxa* have the flowers and fruit of "*Dolia*" but are small erect annual herbs. Large corollas are associated with the nutlets and habit of "*Dolia*" in such species as *N. flaccida, N. mollis, N. pilosa, N. leptophylla, N. lycioides,* etc. If we finally admit that corollas and fruit can not be used in defining "*Dolia*" and frankly admit that the genus is based only on the shrubby habit, we quickly get into more difficulties. In *Nolana,* in the broad sense, there are various species that exhibit transitions between the extremes of shrubby and herbaceous habit. Are such suffruticose species as *N. Gayana, N. intonsa* and *N. pallidula* to be placed in "*Dolia*"? They have numerous, pluriseriate nutlets but do have a habit which approaches that of such "*Dolias*" as *N. tarapacana, N. linearifolia* and even some forms of *N. crassulifolia.* Finally even within some species of "*Dolia,*" such as *N. confinis, N. pilosa* and *N. linearifolia,* there is uncertainty of habit, some forms being shrubby and perennial and others distinctly herbaceous and annual. I am quite unable to see how "*Dolia*" can be defined unless such species as *N. galapagensis,* the annual "Dolias," and certain of the large-flowered species, despite their evident relationship among the various "True Dolias," are arbitrarily set off and treated as distinct genera. This is not only blatantly artificial but, in addition, would have a train of consequences in the classification of the remaining species of *Nolana* and even in such aberrant "Dolias" as *N. thinophila, N. flaccida, N. mollis, N. tarapacana, N. linearifolia*, etc. I am therefore definitely opposed to the recognition of "*Dolia*," not only because I feel it would be artificial but also because of the number of small genera that would invariably have to accompany it.

Some attempt also has been made to segregate from *Nolana* another group of species to form the genus or section "*Sorema*" (*Periloba* is a prior name). This group, typified by *N. paradoxa*, differs from "*Eunolana*," typified by *N. humifusa*, in having the fruit composed of numerous one- to few-seeded, pluriseriate, rather than 5, large, multispermous, uniseriate nutlets. A study of all the species of "*Sorema*" and "*Eunolana*," particularly the Peruvian ones, shows a wealth of transitions between these two extremes of fruit. "*Sorema*" is usually defined as including herbaceous perennials with broad leaves and large flowers. In fact, however, the habit varies from annual on to perennial with a shrubby caudex, the leaves from narrowly spathulate on to very broad with a distinct blade and petiole, and the corolla from small on to very large and conspicuous. None of these characters varies with the fruit. "*Sorema*" can be given only the most arbitrary limits and as with "*Dolia*" the necessities of clarity in definition would inevitably force generic recognition on certain of the species with embarrassing combinations of characters, and logically upon some of the more striking species, such as *N. Adansoni, N. inflata*, etc. Any segregation of *Nolana* will cause this genus to disintegrate into a galaxy of very small genera. The facts are that the genus *Nolana*, as I have defined it, is composed of many selected, stable combinations of the numerous plays on the extreme variation observable in fruit, flower, habit and vegetative parts. The species are so distinct, their relationship so intricate, and their apparent affinity so dependent on the particular part of the plant stressed, that practicable natural groupings of them inside the genus, even into sections or species-groups, seem impossible to realize.

The taxonomic history of the Nolanaceae contains relatively few important names and has its sources in a relatively small library. The first important contribution to the subject, subsequent to the establishment of the genus *Nolana*, was by Ruiz and Pavon, Fl. Peruv. et Chile. **2**: 6–8, tab. 112–113, who in 1799 redescribed the type-species of the genus from wild plants and associated with it four newly proposed species from southern Peru. In 1836 Gaudichaud collected Nolanaceae at Valparaiso, Cobija and Callao and subsequently appears to have made a study of the family. His only published results, however, are the 16 beautiful folio plates, representing 9 new species and 4 new genera, which appeared in the botanical atlas of the reports on the voyage of the *Bonite.* The dates of this important work will be discussed in another paragraph. Modern classification of the Nolanaceae began with the studies by Lindley, Bot. Reg. **30**: sub tab. 46 (1844), who proposed 4 new genera and gave a synopsis of 19 species. Soon after Lindley's work Miers, Hooker London Jour. Bot. **4**: 365–71 and 498–509 (1845), gave a much more detailed account of the family, discussed its characters and relationships, and added a new genus and 10 newly proposed species. This work by Miers was subsequently reprinted with a few minor changes and the addition of three plates, in his Illustrations of South American Plants, **1**: 45–62, tab. 10–12 (1850). The treatment of Nolanaceae in DeCandolle's Prodromus, **13**[1]: 8–18 (1852), was written by Dunal. Dunal's treatment, largely based upon that of Miers, recognizes 23 species of *Nolana,* 5 of *Dolia,* 3 of *Alibrexia,* and 1 each of *Aplocarya* and *Bargemontia.* It is the last attempt to account for all the species. Many of the species he recognized are now known to be synonymous. Our modern conception of the size, number and diversity of the Nolanaceae began with the work of Philippi in 1860. In this year Philippi published his Florula Atacamensis, 43–45, in which 14 species were described or listed from the deserts of northern Chile. Later in various scattered papers he published additional novelties. His work on the family closed, however, in 1895 with that unfortunate paper, Plantas Nuevas Chilenas, Anal. Univ. Chile **91**: 27–47, in which, of a total of 35 newly proposed species, only 6 seem to be valid. Philippi named many of the species in that great center of the family in the provinces of Atacama and Antofagasta. The number of synonymous species he proposed, however, has been most confusing. The account of the family for the Die Natürlichen Pflanzenfamilien, iv. **3b**: 1–4 (1891), was written by Wettstein. He recognized 3 genera, *Nolana, Alona* and *Dolia,* mentioned 31 species and estimated the total number in the family at 50. Early in 1910 Reiche, Anal. Univ. Chile **125**: 482–507, gave his classification of the Chilean species, recognizing 24 species of *Nolana,* 3 of *Alona* and 13 of *Dolia.* This treatment was subsequently reprinted as part of his Flora de Chile, **5**: 410–435 (1910). It is the most extensive and imposing presentation of the family. It is, however, scarcely more than a half digested compilation, having the familiar blundering approach to his subject and the almost complete lack of any feeling for relationships that characterize all of this author's work. In 1925 the present author collected in the coastal regions of northern Chile and subsequently studied in the Philippi Herbarium at Santiago. The result of this work was a report on the coastal flora of the provinces of Antofagasta and Tarapacá and northwestern Atacama published in 1929. Twenty-four Chilean species of Nolanaceae were discussed, Contr. Gray Herb. **85**: 103–112 and 156–159 (1929). In the same paper, l. c. 174–177, four new species were proposed from southern Peru.

Among those who have published on the Nolanaceae the work of Gaudichaud needs special comment. There is evidence that he intended to publish a revision of the family, but this was never realized. As a part of his study, however, he had prepared the series of 16 folio plates issued, over a decade, in the botanical atlas of the reports of the Voyage of the *Bonite* (tab. 8, 28, 33, 101–113). No descriptive text nor any designation of types was ever published by him for the 4 new genera and the 9 new species illustrated. The new species, being beautifully illustrated with a wealth of elaborate details, are legitimately published according to the rules of nomenclature. The new genera, as shown by Sprague, Kew Bull. 395 (1928), are also to be accepted. The date of publication to be assigned to these plates, however, has been a matter of dispute, those suggested varying as follows, 1839–51, 1839–46, 1844–66, 1846–49, etc. Fortunately the plates can be dated with some precision. Plates 8 and 28 are among those listed in Isis von Oken, p. 626, in 1842. Plate 8 is in livraison 1 which was listed by Baillieré, the London dealer who supplied this work to the library of the British Museum, in his invoice to the British Museum dated June 5, 1841. Plate 28, was in livraison 3, the publication of which was advertised in the Bibliographie de la France on Dec. 4, 1841. Plate 33 was in livraison 4 noted in the Baillieré invoice dated April 2, 1842. The early livraisons of the atlas contained 10 plates, but beginning with plate 101 they contained only 6. Plates 101–106 form livraison 19; 107–112 form livraison 20; and 113–118, livraison 21. The plates 101–118 in the library of the British Museum are all stamped "3JU52." This same accession date appears on Baillieré's invoice, dated Jan. 9, 1852, in which liv. 19, 20 and 21 are itemized. It is evident that Baillieré in London could not have received these three livraisons and had them ready to send to the British Museum within nine days of their first issue in Paris. It seems probable, therefore, that they must have been first issued in Paris near the close of 1851. In the present paper I have given the dates of plates 101–113 as "1851–52." The earlier date, however, is probably correct.

The Nolanaceae illustrated by Gaudichaud are based only in part upon the collections he made while botanist during the voyage of the *Bonite* in 1836 and 1837. During that voyage the *Bonite* visited only three ports within the range of the family, Valparaiso (June 11–24, 1836), Cobija (July 1–3, 1836), and Callao (July 11–21, 1836). Of the 16 plates of the Nolanaceae in the botanical atlas of the reports of the voyage of the *Bonite*, plates 33, 102, 103, 104, 106, 108, 111 and 112 represent species neither known nor to be expected at ports mentioned. Some of the illustrations were doubtless based upon the material collected by Gaudichaud during 1831 when he was attached to the frigate *l'Herminie* (under Capt. Villenueve de Bargemont) and visited Valparaiso, Coquimbo ("vu dans la plus mauvaise saison"), and Callao. Others are no doubt based upon collections by Bridges and possibly by Gay.

The location of Gaudichaud's type-specimens, that is to say the specimens from which his plates were drawn, remains uncertain. There are duplicates of some of the collections made during the *Bonite* voyage now preserved at Paris, Geneva, Berlin and Chicago. Few of these seem to have been actually determined by Gaudichaud himself. At Paris and Geneva I have seen some of the collections made by Gaudichaud during the voyage of *l'Herminie*. In none of the herbaria mentioned have I seen material of *Nolana polymorpha* Gaud. As Brongniart, Ann. Sci. Nat. Bot. ser. 6, **1**: 263 and 290, adnot. (1875), has suggested, I am inclined to believe that Gaudichaud's missing types may be found in the Webb collections at Florence. I found some of his memoranda and a few of his identifications among the Nolanaceae in the herbarium at Paris. We may suspect that most of his studies were based upon specimens in the Webb Herbarium which he could have consulted in Paris before it was finally sent to Italy.

In the early monographs of the Nolanaceae by Lindley and by Miers, many of the newly proposed species were based upon collections by Bridges and by Cuming. These collections, very important in the history of our family, were distributed with inadequate geographic data and in some cases, especially in Hooker's herbarium which was studied by Miers, were actually mislabeled or the numbers interchanged. Fortunately much of the confusion enveloping these collections can be dispelled. For convenience general facts regarding these collections are given here. Details and discussion of the particular cases of confusion will be found in the treatment of the species concerned.

Thomas Bridges collected from Copiapó to Coquimbo in 1841 and made the first representative collection of the flora of western Atacama. Coming from an unexplored region rich in Nolanaceae his collections contained a large proportion of then unknown species. These were subsequently named and described by Lindley and by Miers. Unfortunately Bridges' collections suffered badly through careless handling. Although he prepared a list (now preserved in the library of the botany department at South Kensington) in which data on habit, flower-color and collecting-locality are given for each of his numbered collections, his specimens were distributed either as from "Coquimbo," which is usually incorrect, or as from "Concepcion," which is grotesquely so. What is more, as noted by Miers, Ill. So. Am. Pl. **2:** 25, adnot. (1857), his specimens have frequently had their numbers interchanged or badly misread. Those in Lindley's herbarium seem to be prevailingly correct. However, those in Hooker's herbarium, which were studied by Miers, are badly confused. For clarity, therefore, I am giving here all the data on the Nolanaceae contained in Bridges's numerical list.

No. 1322. Annual, 6 inches high, flowers white, abundant on the sandy hills and plains between Copiapó and Huasco.—In the Hooker collections this specimen is falsely associated with no. 1323. The collection is the type of both *Alona baccata* Lindl. and *Sorema linearis* Miers.

No. 1323. Shrub, 2–3 ft. high, flowers pale blue, near coast between Huasco and Coquimbo.—In the Hooker collections falsely numbered 1325. It is the type of *Alona ericifolia* Miers.

No. 1324. Shrub 1–3 ft. high, flowers pale blue, near coast, Coquimbo. —Correctly numbered in the Hooker collections. This is the type-collection of *Dolia clavata* Miers.

No. 1325. "Cuchipepo," annual, 1 ft. high, flowers blue, near coast, Coquimbo.—In the Hooker collections bearing the no. 1322. This is the type of *Sorema acuminata* Miers.

No. 1326. Shrub 1–2 ft. tall, flowers blue, near Vallenar in dry stony places.—In the Hooker collections bearing the number 1327. This specimen is the type of *Alona rostrata* Lindl.

No. 1327. Shrub 1–2 ft. high, flowers white, with last, a white flowered form.—In the Hooker collections numbered 1326. The type-collection of *Alona obtusa* Lindl.

No. 1328. Shrub 1–3 ft. tall, flowers pale blue, near port of Peña Blanca, between Huasco and Coquimbo.—Correctly numbered in the Hooker herbarium. The type-collection of *Alona carnosa* Lindl.

No. 1329. Shrub 1–3 ft. tall, flowers dark blue, hills near the town of Frierina, Valley of Huasco, a splendid flower.—Correctly numbered in the Hooker collections. This specimen represents *Alona coelestis* Lindl.

No. 1330. Shrub 1–3 ft. tall, flowers white, coast between Huasco and Coquimbo.—This collection appears in the Hooker collections under no. 1331 and though correctly numbered in the Lindley herbarium was misread and cited by Lindley as no. 1336. It represents *Nolana sedifolia*.

Hugh Cuming collected some Nolanaceae about Valparaiso but his collections of most concern to us are contained in three blocks of numbers given in a list at South Kensington as follows,—nos. 853–911, "Coquimbo," August 1828; Nos. 912–959, "Cobija, Iqueque and Arica," Sept. and Oct. 1828; and nos. 960–1090, "Peru," Nov. and Dec. 1828. Specimens of the second block, nos. 912–959, appear in the Hooker herbarium incorrectly labeled as from Peru and even as from Lima. The one specimen of the Nolanaceae of this block, the type of *Dolia leptophylla* Miers, probably came from Cobija. From my study of the collections made by Cuming, in the Nolanaceae as well as in other families, it is increasingly apparent that his block of numbers, 853–911, usually appearing on labels as from "Coquimbo," really covers material, part of which must have been obtained along the coast north of that port. Since Cuming traveled by a small boat and in 1828 was still primarily a collector of shells, we may believe that the questioned plants were obtained near some of his anchorages as he slowly worked northward and that they were grouped with those he obtained at his last important port of call, Coquimbo. I am willing to believe that some of the block, nos. 853–911, may have been obtained as far north as Huasco or even Caldera or Taltal. In any case, as regards Cuming's locality "Coquimbo," one must be prepared to interpret it broadly.

For the preparation of this study of the Nolanaceae I have worked in the herbaria of the Royal Botanic Gardens at Kew (K), the British Museum at South Kensington (BM), the Lindley Herbarium at Cambridge University (Lind.), the Botanical Institute at Hamburg (Hamburg), the Botanical Museum at Berlin-Dahlem (BD), the Delessert and the Barbey-Boissier herbaria at Geneva (Deles.; DC; Boiss.), and the Museum of Natural History at Paris (Paris). Through the kindness of the several curators, certain specimens of particular interest, which I had extracted from the herbaria at Kew, South Kensington, Hamburg, Berlin, and Paris, were later sent to the Arnold Arboretum for more detailed final study. During the final work on the paper I also had available at the Arnold Arboretum loans of the entire representation of the family from the Gray Herbarium (G), the New York Botanic Garden (NY), the United States National Herbarium (US) and the Field Museum (FM). With two exceptions I have seen during the course of the work on this paper all the important collections of the Nolanaceae. The Webb Herbarium at Florence was not seen, but of the Gaudichaud collections, which make Florence important, I have seen various duplicates at Berlin, Geneva and Paris.

The Philippi Herbarium at Santiago (MS) was not studied for this paper, but was visited during my year in Chile in 1925–26 when I collected many Nolanaceae in northern Chile and named and compared them with Philippi's types at Santiago. The notes and the identifications which I made in the Philippi Herbarium, and the numerous specimens which were named and distributed by Philippi and are now preserved at Kew, South Kensington, Berlin, and Washington, have served as an adequate basis for the judgment of Philippi's work on the family. In my work at the various museums and in my requests for loans I have uniformly met with kindness and sympathetic interest. This paper could not have been written without the friendly cooperation of the curators and workers in the institutions mentioned. For their help and many courtesies I am most grateful.

Nolanaceae Dumort.

Nolanaceae Dumortier, Analy. Fam. Pl. 24 (1829); Lindley, Nixus Pl. 18 (1833); Martius, Consp. Reg. Veg. 21 (1835); Lindley, Nat. Syst. ed. 2, 229 (1836), excl. *Falkia* and *Dichondra;* Endlicher, Gen. Pl. 655 (1838); Meisner, Pl. Vasc. Gen. **1**: 275 and **2**: 182 (1840); Endlicher, Ench. Bot. 326 (1841); Lindley, Bot. Reg. **30**: sub tab. 46 (1844); Miers, Hooker London Jour. Bot. **4**: 366 and 514 (1845), excl. *Grabowskya;* Lindley, Veg. Kingd. 654 (1847); Agardh, Theor. Syst. Pl. 360 (1858); Wettstein in Engler and Prantl, Nat. Pflanzenfam. iv. **3b**: 1 (1891); Dalla Torre and Harms, Gen. Siphonogam. 448 (1904).

Nolanales Lindley, Nixus Pl. 18 (1833).

Nolaneae, (sect. Solanac.) Reichenbach, Consp. Reg. Veg. 125 (1828), excl. *Triguera;* (tribo Solanac.) Lindley, Nat. Syst. 233 (1830); (familia) Brongniart, Enum. Gen. Pl. 55 (1843); (tribo Nolanac.) Miers, Hooker London Jour. Bot. **4**: 514 (1845); (tribo Solanac.) Dunal in DeCandolle, Prodr. $\mathbf{13}^1$: 8 (1852), excl. *Grabowskya;* (familia) LeMaout and Decaisne, Traité Gén. Bot. 181 (1868); (tribo Solanac.) Eichler, Blüthendiagr. **1**: 206 (1875); (tribo Convolvulac.) Bentham and Hooker, Gen. Pl. **2**: 867 and 879 (1876); (sect. Solanac.) Baillon, Hist. Pl. **9**: 312 and 352 (1888); (? sect. Solanac.) Solereder, Syst. Anat. Dicotyled. 648 (1899).

Nolanieae (tribo Solanac.) G. Don, Gen. Syst. **4**: 479 (1837).

Nolanineae (subtribo Solanac.) Dunal in DeCandolle, Prodr. $\mathbf{13}^1$: 9 (1852).

Nolanidia (familia), Rafinesque, Analys. Nat. 186 (1815), excl. *Siphonanthus,* and Fl. Tellur. **4**: 87 (1838).

Nolanidae (familia) Burnett, Outlines Bot. **2**: 1106 (1835).

KEY TO THE GENERA.

Fruit schizocarpic, rounded or merely 5-sulcate, composed of 5 multispermous sections which are broadly affixed to the receptacle and are broadly joined to one another laterally; plants shrubby .... 1. *Alona.*

Fruit deeply lobed, composed of 3 to many, few- to many-seeded, distinct nutlets which are attached only to the receptacle and are free or practically so from one another; plants herbs or shrubs. . 2. *Nolana.*

1. **Alona** Lindl.

Alona Lindley, Bot. Reg. **30**: tab. 46 (1844); Walpers, Repert. **6**: 548 (1847); Bentham and Hooker, Gen. Pl. **2**: 879 (1876); Wettstein in Engler and Prantl, Nat. Pflanzenfam. iv. **3b**: 3 (1891) Reiche, Anal. Univ. Chile **125**: 494 (1910) and Fl. Chile **5**: 422 (1910).—Type-species: *Alona coelestis* Lindl.

Nolana sect. *Alona* (Lindl.) Miers, Hooker London Jour. Bot. **4**: 500 (1845) and Ill. So. Am. Pl. **1**: 53 (1850); Dunal in DeCandolle, Prodr. **13**[1]: 13 (1852).

Rayera Gaudichaud, Bot. Voyage Bonite, Atlas tab. 108 (1851–52).—Type-species: *R. teretifolia* Gaud. (*Alona rostrata* Lindl.).

Osteocarpus Philippi, Gartenflora **33**: 39 and 356, tab. 1175 (1884); Philippi, Anal. Univ. Chile **91**: 40 (1895).—Type-species: *Alona rostrata* Lindl.

KEY TO THE SPECIES.

Calyx with lobes only 1–3 mm. long, split and becoming deeply 1–2-cleft by the expanding corolla.
  Shrub slender-stemmed and loosely branched; leaves more or less scattered, terete and slender, ascending; corolla 2–2.5 cm. long; pedicels usually short, becoming 5–8 mm. long .... 1. *A. rostrata.*
  Shrub low and dense; leaves crowded, short, triquetrous, divergent; corolla 2.5–3 cm. long; pedicels becoming 10–25 mm. long. 2. *A. carnosa.*
Calyx with well developed lobes, 3–9 mm. long, not split by the expanding corolla.
  Stems, leaves and calyx finely glandular and usually distinctly resinous; not at all hairy.
    Calyx-lobes linear, separated by very broad rounded open sinus. 3. *A. filifolia.*
    Calyx-lobes subulate, separated by narrow acute sinus. 4. *A. balsamiflua.*
  Stems, leaves and calyx covered with fine soft spreading more or less glandular hairs.
    Leaves 0.3–0.9 mm. broad, very slender; shrubs 3–10 dm. tall; calyx cut only down to middle .... 5. *A. coelestis.*
    Leaves 1–2.5 mm. broad; shrub spreading, 1.5–3 dm. tall; calyx cut to beyond the middle .... 6. *A. stenophylla.*

1. **Alona rostrata** Lindl.

Alona rostrata Lindley, Bot. Reg. **30**: sub tab. 46 (1844); Gay, Fl. Chile **5**: 110 (1849); Reiche, Anal. Univ. Chile **125**: 495 (1910) and Fl. Chile **5**: 423 (1910).—Type given as from Coquimbo, but in fact from Vallenar, *Bridges 1326*.

Nolana rostrata (Lindl.) Miers ex Dunal in DeCandolle, Prodr. **13**[1]: 14 (1852).

Osteocarpus rostratus (Lindl.) Philippi, Gartenflora **33**: 356 and 38, tab. 1175 (1884) and Anal. Univ. Chile **91**: 40 (1895).

Alona obtusa Lindley, Bot. Reg. **30**: sub tab. 46 (1844); Gay, Fl. Chile **5**: 110 (1849); Reiche, Anal. Univ. Chile **125**: 497 (1910) and Fl. Chile **5**: 425 (1910).—Type given as from Coquimbo, but in fact from Vallenar, *Bridges 1327*.

Nolana obtusa (Lindl.) Miers ex Dunal in DeCandolle, Prodr. **13**[1]: 14 (1852).

Rayera teretifolia Gaudichaud, Bot. Voyage Bonite, Atlas tab. 108 (1851–52).—Type never indicated.

Alona Miersii Philippi ex Wettstein in Engler and Prantl, Nat. Pflanzenfam. iv. **3b**: 3 (1891), nomen; Philippi, Anal. Univ. Chile **91**: 35 (1895), description; Reiche, Anal. Univ. Chile **125**: 496 (1910) and Fl. Chile **5**: 424 (1910).—Type collected at Chañarcillo in 1885.

Alona phylicifolia Philippi ex Wettstein in Engler and Prantl, Nat. Pflanzenfam. iv. **3b**: 3, fig. 1 (1891), nomen; Philippi, Anal. Univ. Chile **91**: 36 (1895), description; Reiche, Anal. Univ. Chile **125**: 496 (1910) and Fl. Chile **5**: 424 (1910).—Type collected at Caldera by Paul Ortega in 1879.

Alona Fonckii Philippi, Anal. Univ. Chile **91**: 36 (1895); Reiche, Anal. Univ. Chile **125**: 496 (1910) and Fl. Chile **5**: 424 (1910).—Type collected at La Higuera, prov. Coquimbo in Jan. 1886 by Francisco Fonck.

Osteocarpus brevifolius Philippi, Anal. Univ. Chile **91**: 40 (1895).—Based upon collections from Chañarcillo and Pabellon, prov. Atacama.

Osteocarpus lepidophyllus Philippi, Anal. Univ. Chile **91**: 42 (1895).—Type collected Sept. 1885 near Caldera by F. Philippi.

Alona lepidophylla (Phil.) Reiche, Anal. Univ. Chile **125**: 497 (1910) and Fl. Chile **5**: 425 (1910).

Nolana lepidophylla (Phil.) Johnston, Contr. Gray Herb. **85**: 103 (1929).

CHILE: Arid hillsides back from the coast, from the northern parts of the province of Coquimbo northward into Atacama to beyond the Copiapó Valley, lat. 29° 30′ to 27° S.

SELECTED SPECIMENS: La Higuera, *Fonck* (BM, ISOTYPE of *A. Fonckii*); near Vallenar, in dry stony places, shrub 3–6 dm. tall, corolla light blue, *Bridges 1326* (Lindl., TYPE of *A. rostrata*); near Vallenar, in dry stony places, shrub 3–6 dm. tall, corolla white, *Bridges 1327* (Lindl.; K, TYPE of *A. obtusa*); Alto de Carmen, in valley above Vallenar, small shrub 4 dm. tall, corolla blue, *Werdermann 150* (G, BD) Chañarcillo, *Philippi* as *A. Miersii* (US, K, BD); Chañarcillo, Sept. 24, 1885, *Borchers* as *A. rostrata* (BM); dry slopes near Tierra Amarilla, *Werdermann 412* (G, BD); Quebrada de Chanchoquin, north of Copiapó, 1885, *Gigoux* (G).

This is a very slender, loosely branched, sprawling shrub. It has accumulated a surprising number of synonyms. It should be noted that in his catalogue Bridges listed his nos. 1326 and 1327, the types of *A. rostrata* and *A. obtusa,* as collected in the same locality and as representing the normal blue-flowered form and an albino form of the same species. The species is a very distinct one and has evident relations only in *A. carnosa.*

2. **Alona carnosa** Lindl.

Alona carnosa Lindley, Bot. Reg. **30:** sub tab. 46 (1844); Gay, Fl. Chile **5:** 111 (1849); Reiche, Anal. Univ. Chile **125:** 496 (1910) and Fl. Chile **5:** 424 (1910).—Based upon material cited, "Coquimbo (herb. Bridges, 1328; Cuming, 863)." This was probably collected, however, well to the north of the port of Coquimbo.

Nolana carnosa (Lindl.) Miers ex Dunal in DeCandolle, Prodr. **13**[1]: 14 (1852).

Alona vernicosa Philippi, Fl. Atac. 44 (1860) and Viage Des. Atac. 10 and 218 (1860).—Type collected at Caldera by Philippi.

Alona sedifolia Philippi, Cat. Pl. Itin. Tarapaca 69 (1891).—Type given as from Chiapa, lat. 19° 32′ S., long. 69° 12′ W., but probably in fact from Caldera.

Alona grandiflora Philippi, Anal. Univ. Chile **91:** 37 (1895).—Type from northern Chile.

Chile: Sandy plains of the prov. Atacama, from Caldera to Peña Blanca, chiefly along the ocean. Reports from Coquimbo are questionable.

Selected specimens: Caldera, *ex Philippi* as *A. vernicosa* (BM); Caldera, bush 3–10 dm. tall, dominant on sandy plain, 1925, *Johnston 5047* (G); dunes north of Caldera, suffruticose, 15 cm. tall, 1924, *Werdermann 383* (G, BD); Caldera, Oct. 20, 1890, *Morong 1274* (FM); Caldera, 3–6 dm. tall, sandy places, 1864, *Pearce* (K, BM); Chañarcito, Sept. 24, 1885, *Borchers* (BM); near port of Peña Blanca between Huasco and Coquimbo, shrub 3–6 dm. tall, *Bridges 1328* (Lindl., K); "Coquimbo," *Cuming 863* (K, BM).

A very distinct species having evident relations with *A. rostrata.* Its relative is very slender, laxly branched and sprawling. *Alona carnosa* is a compact densely and ascendingly branched bush with abundant triquetrous leaves and larger fruit and flowers. It is a plant of the sandy coastal plains and not, as is its relative, a frequenter of rocky hillsides of the interior.

While at Santiago in 1926 I compared the type of *A. sedifolia* with material collected at Caldera and found them specifically identical. Since *A. carnosa* is indubitably known only from the coastal region of western Atacama there is good reason for questioning the accuracy of the label accompanying the type of *A. sedifolia*. The type of *A. sedifolia* is said to have come from Chiapa in the high deserts of the province of Tarapacá, almost 190 km. east of the port of Pisagua. It is, however, more credible to think that the type of *A. sedifolia* was collected at Caldera, the starting point of the expedition that collected it, and that subsequently the specimen was somehow mislabeled.

3. **Alona filifolia** (H. & A.), comb. nov.

Convolvulus ? filifolius Hooker and Arnott, Bot. Beechey Voyage **1**: 35 (1830); Hallier, Bull. Herb. Boiss. **6**: 720 (1898).—Type collected at Coquimbo.

Nolana filifolia (H. and A.) Johnston, Revista Chilena **34**: 231 (1930).

Convolvulus linifolius Hooker and Arnott ex Choisy in DeCandolle, Prodr. **9**: 389 (1845); Hallier, Bull. Herb. Boiss. **6**: 721 (1898).—lapsu calami.

Nolana Chastenayana Gaudichaud, Bot. Voyage Bonite, Atlas tab. 33 (1842); Dunal in DeCandolle, Prodr. **13**[1]: 14 (1852).—Types never indicated.

Alona Chastenayana (Gaud.) Gaudichaud ex Wettstein in Engler and Prantl, Nat. Pflanzenfam. iv. **3**b: 3 (1891).

Alona glandulosa Lindley, Bot. Reg. **30**: sub tab. 46 (1844); Gay, Fl. Chile **5**: 111 (1849); Reiche, Anal. Univ. Chile **125**: 497 (1910) and Fl. Chile 5: 425 (1910).—Type collected at Coquimbo by Macrae in 1825.

Nolana glandulosa (Lindl.) Miers ex Dunal in DeCandolle, Prodr. **13**[1]: 14 (1852).

Ipomoea Cruckshanksii Choisy in DeCandolle, Prodr. **9**: 389 (1845); Hallier, Bot. Jahrb. **16**: 559 (1893) and Bull. Herb. Boiss. **6**: 723 (1898). —Type collected at Coquimbo by Cruckshanks.

Fabiana grandiflora Dunal in DeCandolle, Prodr. **13**[1]: 591 (1852); Reiche, Anal. Univ. Chile **124**: 761 (1909) and Fl. Chile **5**: 377 (1910). —Type collected by Gay in the province of Coquimbo, probably on hills about La Serena.

? Osteocarpus foliolosus Philippi, Anal. Univ. Chile **91**: 42 (1895).—Type collected by F. Philippi in Queb. de Injenio near Ovalle.

Chile: Dry gravelly benches and hillsides in the province of Coquimbo, lat. 29° 30′ to 31° S. mostly back from the coast.

Selected specimens: Coquimbo, 1831, *Gaudichaud 65* (Paris), *Harvey* (G), *Macrae* (Lindl. Deles. K); shrub 5 dm. tall, common on hills about La Serena, *Gay 2* (Paris); Coquimbo, shrub 6–9 dm. tall in dry rocky places, *Elliott 5* (K); Vicuña, 900–1200 m. alt., *Elliott 94* (K); Fray Jorge, low slender shrub 2 dm. tall, *Werdermann 928* (G, BD).

The first *Alona* known to science. It was collected near Coquimbo by Macrae in Nov. 1825 and described subsequently as a species of *Convolvulus*. Extending into the southern parts of the province of Coquimbo it sets the southern limit for the dispersal of the genus. The species is a well marked one.

4. **Alona balsamiflua** Gaud.

Alona balsamiflua Gaudichaud, Bot. Voyage Bonite, Atlas tab. 107 (1851–52).—Type collected at Cobija by Gaudichaud.

CHILE: Known only from Cobija, prov. Antofagasta, lat. 22° 30′ S.

I know of only two collections of this interesting plant, both from Cobija, one by d'Orbigny (no. 275) in April 1830, and the other by Gaudichaud in July 1836. Gaudichaud published an excellent, elaborately detailed illustration of his plant. No description of this very distinct species has ever been published. *Alona balsamiflua* is the most northerly ranging species of its genus.

5. **Alona coelestis** Lindl.

Alona coelestis Lindley, Bot. Reg. **30**: tab. 46 (1844); Paxton, Mag. Bot. **12**: 3, cum tab. (1845); Gay, Fl. Chile **5**: 110 (1849); Gaudichaud, Bot. Voyage Bonite, Atlas tab. 106 (1851–52); (*A. caelestis*) F. Philippi, Cat. Pl. Vasc. Chile 230 (1881); Reiche, Anal. Univ. Chile **125**: 498 (1910) and Fl. Chile **5**: 426 (1910).—Based upon garden material raised from seeds collected by Bridges in Chile and upon herbarium material cited as from, "Coquimbo, (herb. Cuming, 857; Bridges, 1329)."

Nolana coelestis (Lindl.) Miers ex Dunal in DeCandolle, Prodr. **13**^{1}: 13 (1852); (*N. caelestis*) F. Philippi, Cat. Pl. Vasc. Chile 230 and 232 (1881).

Alona ericifolia Miers, Hooker London Jour. Bot. **4**: 500 (1845) and Ill. So. Am. Pl. **1**: 54 (1850); Gay, Fl. Chile **5**: 112 (1849); Reiche, Anal. Univ. Chile **125**: 497 (1910) and Fl. Chile **5**: 425 (1910).—Type labelled as being "*Bridges 1325*" and as from "Concepcion." The collection, however, is really *Bridges 1323* and actually from between Huasco and Coquimbo.

Nolana ericifolia (Miers) Miers ex Dunal in DeCandolle, Prodr. **13**^{1}: 14 (1852).

Alona floribunda Philippi, Anal. Univ. Chile **43**: 525 (1873).—Type from Huasco.

CHILE: Mostly near the coast; best known from the southwestern parts of the province of Atacama in the lower Huasco Valley. Otherwise known only from near Coquimbo.

SELECTED SPECIMENS: Huasco, *Reed* as *A. floribunda* (K, BM); Huasco, *ex Philippi* as *A. floribunda* (BM, BD, Deles.); Huasco, *Jaffuel 1173* and *1190* (G); hills near Freirina, shrub 3–9 dm. tall, *Bridges 1329* (Lindl., TYPE); near coast between Huasco and Coquimbo, shrub 6–9 dm. tall, flowers pale blue, *Bridges 1323* (Lindl.; sub no. 1325, K, TYPE of *A. ericifolia*); Coquimbo, *Cuming 857* (K), *Gaudichaud 66*, *67* and *72* (Paris).

Although Lindley, in describing *A. coelestis*, cites *Bridges 1329* as from Coquimbo it is to be noted that Bridges in his plant-list gives this number as collected in the hills near the town of Freirina in the valley of Huasco. He notes that it is "a splendid flower." The garden material illustrated by Lindley is said to have been raised from seeds sent by Bridges. These also may have come from Freirina.

6. **Alona stenophylla** (Johnston), comb. nov.

Nolana stenophylla Johnston, Contr. Gray Herb. **85**: 103 (1929).—Type from near Aguada del Cardon, *Johnston 5272*.

CHILE: Gravelly bench near the sea, prov. Antofagasta, lat. 24° 45′ S.

Known only from the type-collection. A lax decumbent shrub 1.5–3 dm. tall. The species is a very distinct one with its closest relative, perhaps, in *A. coelestis*.

2. **Nolana** Linn.

Nolana Linnaeus, Sp. Pl. ed. 2, **1**: 202 (1762), nomen; Linnaeus fil. Dec. Pl. Rar. Hort. Upsala **1**: 3, tab. 2 (1762); Linnaeus, Gen. Pl. ed. 6, 79 (1764); Linnaeus, Syst. ed. 12, 149 (1767); Endlicher, Gen. Pl. 655 (1839); Dunal in DeCandolle, Prodr. **13**[1]: 9 (1852); Bentham and Hooker, Gen. Pl. **2**: 879 (1876); Wettstein in Engler and Prantl, Nat. Pflanzenfam. iv. **3b**: 2 (1891); Reiche, Anal. Univ. Chile **125**: 483 (1910) and Fl. Chile **5**: 411 (1910).—Type-species: *N. prostrata* Linn. (*N. humifusa* Johnston).

Nonala Linnaeus ex Durand, Ind. Gen. Phan. 287 (1888), lapsu calami.

Tula Adanson, Fam. Pl. **2**: 500 (1763), mononomial; Poiret, Encyc. Meth. **8**: 131 (1808), mononomial; Roemer and Schultes, Syst. **4**: pg. xxv. (1819); Jussieu, Mem. Mus. Paris **6**: 385 (1820); DeCandolle, Prodr. **4**: 418 (1830); G. Don. Gen. Syst. **3**: 524 (1834); Endlicher, Gen. Pl. 550 (1838); Meisner, Pl. Vasc. Gen. **1**: 159 (1838) and **2**: 114 (1838); Dunal in DeCandolle, Prodr. **13**[1]: 13 adnot. (1852); Bentham and Hooker, Gen. Pl. **2**: 29 (1873); Dalla Torre and Harms, Gen. Siphonogam. 509 (1905).—Type-species: *T. Adansoni* R. and S.

Tuba Adanson ex Spach, Hist. Veg. **8**: 373 (1839), lapsu calami.

Neudorfia Adanson, Fam. Pl. **2**: 219 and 582 (1763), mononomial.

Neudorffia Adanson ex Steudel, Nomencl. 553 (1821), lapsu calami.

Zwingera Hofer, Acta Helv. **5**: 267, tab. 1 (1763–64); Necker, Elem. **3**: 385 (1790).—Type-species: *Atropa humifusa* Gouan.

Swingera Hofer ex Dunal in DeCandolle, Prodr. **13**[1]: 9 (1852), lapsus.

Walkeria Miller ex Ehret, Phil. Trans. London **53**: 131, tab. 10 (1764), mononomial.

Teganium Schmidel, Icon. Pl. 67, tab. 18 (1766?), mononomial.

Periloba Rafinesque, Fl. Tell. **4**: 87 (1838); Johnston, Contr. Gray Herb. **85**: 104 (1829).—Type-species: *N. paradoxa* Lindl.

Nolana subgen. *Iohypa* Rafinesque, Fl. Tell. **4**: 87 (1838).—Type-species: *N. prostrata* L.

Nolana subgen. *Periesta* Rafinesque, Fl. Tell. **4**: 87 (1838).—Type species: *N. coronata* R. and P.

Nolana subgen. *Spatulina* Rafinesque, Fl. Tell. **4**: 87 (1838).—Type-species: *N. spathulata* R. and P.

Nolana subgen. *Gastrina* Rafinesque, Fl. Tell. **4**: 87 (1838).—Type-species: *N. inflata* R. and P. and *N. revoluta* R. and P.

Bargemontia Gaudichaud, Bot. Voyage Bonite, Atlas tab. 8 (1841); Walpers, Repert. **6**: 551 (1847); Dunal in DeCandolle, Prodr. **13**[1]: 18 (1852); Bentham and Hooker, Gen. Pl. **2**: 880 (1876); Johnston, Contr. Gray Herb. **85**: 105 (1929).—Type-species: *B. peruviana* Gaud.

Sorema Lindley, Bot. Reg. **30**: sub tab. 46 (1844); Walpers, Repert. **6**: 547 (1847); Miers, Hooker London Jour. Bot. **4**: 368 (1845) and Ill. So. Am. Pl. **1**: 48 (1850).—Type-species: *N. paradoxa* Lindl.

Nolana sect. *Sorema* (Lindl.) Miers, Hooker London Jour. Bot. **4**: 500 (1845) and Ill. So. Am. Pl. **1**: 53 (1850); Dunal in DeCandolle, Prodr. **13**[1]: 11 (1852); Wettstein in Engler and Prantl, Nat. Pflanzenfam. iv. **3b**: 3 (1891); Reiche, Anal. Univ. Chile **125**: 483 (1910) and Fl. Chile **5**: 411 (1910).

Dolia Lindley, Bot. Reg. **30**: sub tab. 46 (1844); Walpers, Repert. **6**: 551 (1847); Bentham and Hooker, Gen. Pl. **2**: 880 (1876); Dunal in DeCandolle, Prodr. **13**[1]: 15 (1852); Miers, Hooker London Jour. Bot. **4**: 502 (1845) and Ill. So. Am. Pl. **1**: 55, tab. 12 (1850); Wettstein in Engler and Prantl, Nat. Pflanzenfam. iv. **3b**: 3 (1891); Reiche, Anal. Univ. Chile **125**: 501 (1910) and Fl. Chile **5**: 429 (1910).—Type-species: *D. vermiculata* Lindl. (*N. sedifolia* Poepp.).

Aplocarya Lindley, Bot. Reg. **30**: sub tab. 46 (1844); Walpers, Repert. **6**: 55 (1847); Dunal in DeCandolle, Prodr. **13**[1]: 18 (1857).—Type-species: *A. divaricata* Lindl.

Alibrexia Miers, Hooker London Jour. Bot. **4**: 506 (1845) and Ill. So. Am. Pl. **1**: 59, tab. 11 (1850); Walpers, Repert. **6**: 550 (1847); Dunal in DeCandolle, Prodr. **13**[1]: 16 (1852).—Type-species: *A. rupicola* Miers (*N. crassulifolia* Poepp.).

Nolana sect. *Eunolana* Miers, Hooker London Jour. Bot. **4**: 500 (1845) and Ill. So. Am. Pl. **1**: 53 (1850); Dunal in DeCandolle, Prodr. **13**[1]: 9 (1852); Wettstein in Engler and Prantl, Nat. Pflanzenfam. iv.

3b: 2 (1891); Reiche, Anal. Univ. Chile **125**: 483 (1910) and Fl. Chile **5**: 411 (1910).

Gubleria Gaudichaud, Bot. Voyage Bonite, Atlas tab. 104 (1851–52). —Type-species: *G. baccata* [Lindl.] Gaud.

Velpeaulia Gaudichaud, Bot. Voyage Bonite, Atlas tab. 109 (1851–52).—Type-species: *V. alibrexioides* Gaud. (*N. leptophylla* Johnston).

Leloutrea Gaudichaud, Bot. Voyage Bonite, Atlas tab. 110 (1851–52).—Type-species: *L. aplocaryoides* Gaud.

Pachysolen Philippi, Anal. Univ. Chile **91**: 45 (1895), gen. provis.; Reiche, Anal. Univ. Chile **125**: 503 (1910) and Fl. Chile **5**: 431 (1910). —Type-species: *Dolia eremobia* Phil. (*N. incana* Johnston).

Nolana sec. *Pteronolana* Kuntze ex Post and Kuntze, Lexicon 390 (1904).—Type-species: *N. pterocarpa* Phil.

Key to the Species.

Nutlets 10 to numerous, in 2 or more ranks differing in position on the receptacle or in size or both. (cf. nos. 31, 32 and 33).
- Calyx at anthesis irregular, deeply cleft on one side, the lobes elongate, with closed sinus, usually more or less broadened above the middle and hence more or less spathulate.
  - Leaf-blades broadly lanceolate to cordate, abruptly contracted into a slender well developed petiole of about equal length.
    - Blades with base cordate or reniform, 20–40 mm. broad; corolla 3–4 cm. long........................1. *N. spathulata.*
    - Blades with base angulate or rounded, 4–18 mm. broad; corolla 2–3 cm. long..............................2. *N. arenicola.*
  - Leaf-blades spathulate to oblanceolate, gradually contracted towards stem, lacking a distinct well-developed petiole.
    - Blades much compressed, flat, 7–18 mm. broad; calyx-lobes herbaceous, more or less spreading................3. *N. latipes.*
    - Blades very succulent, thick, 2–6 mm. broad; calyx-lobes succulent, erect..............................4. *N. pallidula.*
- Calyx at anthesis symmetrical or nearly so, not cleft on one side, with 5 teeth or lobes which are broadest at the base.
  - Middle cauline leaves gradually expanded from their attachment, without a well defined petiole, linear to spathulate or oblanceolate.
    - Plant an erect shrub becoming nearly a meter tall; corolla white, subtubular, 2–3 times as long as broad; Galapagos Islands...............................5. *N. galapagensis.*
    - Plant an annual herb or more or less herbaceous perennial, with decumbent or prostrate stem; corolla usually blue, funnelform, not much longer than broad; continental.
      - Leaves and stem with a felt-like indument of abundant short forked or stellate hairs; central Peru........6. *N. Gayana.*
      - Leaves and stems with simple hairs or entirely glabrous; Chilean except sometimes no. 12.
        - Plant conspicuously shaggy-villous; calyx not angulate 7. *N. intonsa.*
        - Plant glabrous or with short inconspicuous hairs; calyx angulate.
          - Pedicels 0–3 mm. long, erect; calyx-lobes with broad obtuse tips, unequal, sinus closed........8. *N. sessiliflora.*

Pedicels becoming 1 cm. long or more in maturity, spreading or recurved; calyx-lobes with acute to acuminate tips, equal or practically so, sinus open.
Corolla scarcely if at all surpassing the calyx, white, 4–6 mm. long; a decumbent non-glandular plant with keeled angulate nutlets......9. *N. parviflora.*
Corolla very conspicuously surpassing calyx, over 15 mm. long, blue except in forms of no. 11.
Nutlets compressed laterally and encircled by a broad evident vertical wing; leaf-margins strongly inrolled..................10. *N. pterocarpa.*
Nutlets rounded or angulate, usually irregularly polyhedral, wingless or narrowly and horizontally winged around the apical end.
Plant an erect annual herb, ascendingly branched chiefly above the middle; nutlets frequently with an apical wing; corolla blue or white 11. *N. baccata.*
Plant spreading, prostrate or decumbent, the leafy stems springing from a well developed and usually persisting basal rosette of leaves; corolla blue; nutlets apterous.
Bases of bracts and upper cauline leaves conspicuously long decurrent.
Plant glabrous; corolla 15–20 mm. long. 12. *N. Jaffuelii.*
Plant hairy; corolla 30–50 mm. long..13. *N. elegans.*
Bases of bracts and upper cauline leaves auriculate or abruptly short decurrent.
Plant abundantly stipitate-glandular at least in the inflorescence; leaves elongate, firm, more or less strap-shaped, usually with a subauriculate somewhat clasping sessile base; plant usually perennial from a caudex.......14. *N. rupicola.*
Plant sparsely glandular and hence greener, leaves usually broader and less firm, the bases usually abruptly decurrent; plant annual, never with a shrubby caudex....................15. *N. acuminata.*
Middle cauline leaves with a definite petiole that is abruptly expanded above into a broad flat blade.
Nutlets large, 3–6 mm. long, in at least 2 very distinct ranks, pericarp becoming corky; sea-shore perennial with a deep fleshy tap-root, central Chile................16. *N. paradoxa.*
Nutlets small, 1–3 mm. long, in several crowded and confused ranks, pericarp not corky; plants of coastal deserts of Peru, root not conspicuously fleshy if at all so.
Petiole abruptly expanded into an evident semiamplexicaul stipular base; plant annual, erect, glabrous or nearly so; leaf-blades reniform or cordate..........17. *N. Adansoni.*
Petiole not abruptly expanded and semiamplexicaul at the very base; plant persistent, more or less pubescent; leaf-blades ovate to oblong, base obtuse or rounded.
Leaf-blades glandular villous, thickish, 1–1.5 cm. long; calyx firm, not conspicuously inflated; pedicels 1 cm. long or less; plant from a distinctly woody spreading caudex..............................18. *N. insularis.*

Leaf-blades stipitate-glandular, thin, veiny, large, becoming 5–10 cm. long; calyx bladder-inflated; pedicels very slender, 1–5 cm. long; plant slender, decumbent or ascending....................19. *N. inflata.*
Nutlets less than 10, prevailingly 5, more or less distinctly uniseriate.
Nutlets large, broadly affixed in deep sockets in the receptacle, crowded with their broad flat proximate sides closely appressed to one another.
Plant glabrous or practically so.
Corolla 1.5–2 cm. long; mature calyx with a prominent triangular pleat at the bases of each sinus, hence abruptly contracted beneath the sinus..................20. *N. humifusa.*
Corolla 2–3 cm. long; mature calyx not prominently pleated at the sinus, evenly rounded off beneath it......21. *N. coronata.*
Plant villous and glandular.
Calyx conspicuously plicate, strongly folded between the broad triangular lobes; herbage grayish with abundant short stiffish erect hairs; leaf-margin revolute..........22. *N. plicata.*
Calyx not folded between the lanceolate or oblong obtusish lobes; herbage glabrescent, the few hairs long and weak; leaf-margins not revolute...................23. *N. Guentheri.*
Nutlets smaller, narrowly affixed at or just above the base, more or less globose or ovoid, their proximate sides usually convex (cf. no. 8).
Calyx with 1–2 deep clefts, the proper calyx-lobes reduced, either absent or inconspicuous.
Corolla 2.5–4 cm. broad; plant perennial, shrubby; calyx pubescent, the clefts equal, the resulting segments spreading with their tips 2–4-dentate.........24. *N. polymorpha.*
Corolla ca. 1 cm. broad; plant annual; calyx glabrous and glandular-glutinous, the clefts unequal, the resulting segments with acute edentate tips...........25. *N. thinophila.*
Calyx with 5 regular well developed teeth or lobes, not cleft on the sides.
Plants annual, herbs, stems erect or strongly ascending.
Mature calyces subsessile or with pedicels up to 5 mm. long, erect or spreading but not distinctly reflexed; leaves tending to be congested on the outer half of the branches.
Corolla 10–15 mm. long; leaf-blades obtuse or rounded, contracted into a slender petiole 1–5 mm. long, thick and very fleshy................26. *N. aplocaryoides.*
Corolla 20–25 mm. long; leaf-blades acute, contracted into a slender petiole 6–8 mm. long, distinctly compressed...................................27. *N. Pearcei.*
Mature calyces borne on slender sharply deflexed petioles 6–14 mm. long; leaves more equitably distributed over the plant.
Nutlets strongly and irregularly rugose, angular.
Leaf-blades ovate to deltoid-ovate, 4–10 mm. broad, abruptly contracted into a slender petiole.
28. *N. Weberbaueri.*
Leaf-blades narrowly oblanceolate, 2–3 mm. broad, gradually contracted into the petiole..........29. *N. laxa.*
Nutlets smooth or practically so, globose.
Plant glabrous or nearly so; leaves linear; corolla 2–3 times length of calyx; nutlets 5.........30. *N. gracillima.*

Plants villous; leaves broadly oblanceolate; corolla only shortly surpassing the calyx; nutlets 5–10. 31. *N. platyphylla.*

Plant perennial and more or less evidently shrubby, a few species short-lived and flowering the first year but these prostrate.

Calyx-tube at anthesis cylindrical, lobes only about half length of tube.

Calyx and foliage dry and glabrous; low spreading shrub. 32. *N. flaccida.*

Calyx and foliage with slimy hairs; erect bush ca. 1 m. tall.......................................33. *N. mollis.*

Calyx-tube at anthesis cupulate or rarely if more elongate the lobes evidently more than half the length of the tube.

Calyx-tube completely investing the ripening nutlets and finally irregularly disrupted by them....34. *N. tarapacana.*

Calyx-tube not investing the nutlets nor disrupted by them.

Corolla-lobes deeply notched, the corolla appearing to be 10-lobed..........................35. *N. linearifolia.*

Corolla-lobes rounded or only obscurely notched, the corolla evidently 5-lobed.

Base of filaments thickened and very densely pubescent.

Plant glabrous or with simple hairs.

Branchlets distinctly pubescent; leaves spathulate..........................36. *N. salsoloides.*

Branchlets quite glabrous; leaves broadly clavate.

Plant yellow-green; corolla blue....37. *N. divaricata.*

Plant glaucous; corolla white..........38. *N. glauca.*

Plant covered with forked or stellate hairs; corolla white.

Leaves broadly clavate, from the short petiole abruptly expanded into an ovoid or globose blade..........................39. *N. peruviana.*

Leaves spathulate, gradually expanded upwardly towards the apex.

Plant with erect or ascending stems; commonly a bush a meter or more high; nutlets usually 4.

Corolla twice length of calyx, 10–13 mm. long; leaves 5–11 mm. long....40. *N. albescens.*

Corolla only slightly surpassing calyx, 7–8 mm. long; leaves 15–25 mm. long. 41. *N. Wedermannii.*

Plant with lank prostrate stems.

Corolla 11–13 mm. long; leaves 12–32 mm. long; nutlets usually 5; central Chile. 42. *N. crassulifolia.*

Corolla 6–10 mm. long; leaves 6–18 mm. long; nutlets usually 4; northern Chile.........................43. *N. incana.*

Base of filaments not thickened, glabrous or only sparsely pubescent.

Indument entirely of branched or stellate hairs.

Leaves spathulate or oblanceolate, narrowed at base; indument dense, felty; Peruvian 44. *N. pallida.*
Leaves linear or oblong, not narrowed at base; indument loosely and softly tomentose; Chilean . . . . 45. *N. villosa.*
Indument prevailingly or entirely of simple hairs.
Leaves and young twigs with short-stiped glands or with well developed stiffish erect usually gland-tipped hairs, never tomentose.
Herbage bearing short-stiped glands; erect bushes.
Corolla-tube slender, very long exserted, twice length of calyx; Peru . . . . 46. *N. lycioides.*
Corolla-tube stout, shorter than calyx; Chile.
Calyx strongly deflexed in fruit . . . . 47. *N. deflexa.*
Calyx erect or ascending in fruit.
Leaves very succulent, sparsely glandular; a dense globose bush with very numerous spreading brittle branches . . . . 48. *N. ramosissima.*
Leaves rather firm or at least not conspicuously succulent, densely glandular; bush irregular and not dense . . . . 49. *N. clivicola.*
Herbage with evident erect hairs; sprawling shrubs.
Leaves 10–40 mm. long, 1–5 mm. broad; margins only very inconspicuously revolute . . . . 50. *N. inconspicua.*
Leaves 3–8 mm. long, 1–2 mm. broad, margins usually conspicuously revolute. 51. *N. leptophylla.*
Leaves and young twigs with slender curved or flexuous hairs, usually more or less tomentose.
Corolla white; leaves glabrous above or nearly so; a bush usually ca. 1 m. tall. 52. *N. sedifolia.*
Corolla pink to blue; leaves hairy above; low spreading plants.
Corolla 6–10 mm. long.
Branchlets and leaves with conspicuous loose tomentum; leaves 2–4 mm. long, very numerous and crowded. 53. *N. diffusa.*
Branchlets and leaves with a minute inconspicuous pubescence; leaves 6–15 mm. long . . . . 54. *N. foliosa.*
Corolla 12–18 mm. long.
Foliage densely glandular; a sprawling shrub from a strong root. 55. *N. tocopillensis.*
Foliage with few or no glands; plant loosely branched, prostrate, suffrutescent, short lived annuals or perennials.

Plant slender; corolla 10–13 mm. broad; leaves 5–13 mm. long, 1–2 mm. broad; tomentum tending to become arachnoid or almost wanting. 56. *N. confinis.*

Plant coarser; corolla 13–22 mm. broad; leaves 10–27 mm. long, 1–6 (–8) mm. broad; stems and leaves pilose, the hairs not much intertangled, never arachnoid. 57. *N. pilosa.*

1. **Nolana spathulata** R. & P.

Nolana spathulata Ruiz and Pavon, Fl. Peruv. **2**: 7, tab. 113a (1799); Dunal in DeCandolle, Prodr. **13**^{1}: 10 (1852).—Type said to have been collected at "Pongo et Atiquipa" by Tafalla.

Nolana bipartita Ruiz and Pavon, Fl. Peruv. **2**: 7 (1799).—Apparently a rejected tentative name for *N. spathulata.*

PERU: Known only from the department of Arequipa; originally given as from the province of Camaná, ca. lat. 16° 40′ S., but known to me only from the vicinity of Mollendo, lat. 17° S.

SPECIMENS EXAMINED: Mollendo, 20–200 m. alt., dry sandy places at lower edge of Loma Formation, corolla light blue, Oct. 1902, *Weberbauer 1500* (BD); in the quebrada near Chula, Mejia, 20 m. alt., Oct. 1923, *Guenther and Buchtien* 120 (Hamb.); Mejia, 40 m. alt., Nov. 1923, *Guenther and Buchtien 116* (Hamb.); Peru, *ex herb. Ruiz* (BD, K) and *ex herb. Pavon* (Deles).

I have seen copious authentic collections of this species, from the herbaria of Ruiz and of Pavon, at Kew, Geneva and Berlin. These are obviously merely parts of a single gathering. A comparison of them with the original illustration shows that plate to be one and a half to two times natural size but otherwise quite satisfactory. The species is closely related to *N. arenicola* of the Tacna region. It appears to develop 5 large nutlets and an equal number of wedge-like small ones which are fitted in between the bases of the major nutlets. The faces of the large nutlets are partially attached to the receptacle and partially to each other. It may be noted that Bruns, Mitt. Inst. Bot. Hamburg **8**: 72 (1929), has reported this plant as *N. revoluta.*

2. **Nolana arenicola** sp. nov.

Herba annua glandulari-puberulenta 1–4.5 dm. alta 3–5 dm. diametro; caulibus decumbentibus laxe ramosis fistulosis 2–4 mm. crassis, internodiis 1–5 cm. longis; foliis succulentis compressis subcostatis, lamina ovata vel late lanceolata 1–2.5(–3) cm. longa plana vel angustissime revoluta basi oblique obtusa vel rotunda vel acuta in petiolum gracilem 8–20 (saepe ca. 10) mm. longum abrupte contracta; pedicellis gracilibus 5–20 mm. longis, maturitate rigidioribus decurvatis; corolla coerulea 2–3 (saepissime 2–2.5) cm. longa infundibuliformi, tubo ca. 5 mm. longo intus dense villuloso; filamentis 4–6 mm. longis immam ad basem sparse villulosis; calycibus in anthesi 10–15 mm. longis 3–4(–5) mm. crassis, 1–2-fidis, lobis 5 inaequalibus spathulatis viridi-costatis erectis apice in alabastro libris; calycibus maturis per fructum conspicue distentibus et demum disruptis ca. 8 mm. crassis; fructu ca. 8 mm. diametro ca. 5 mm. alto nuculis 5 majoribus et 5–10 nuculis minoribus constituto; nuculis angulatis rugosis 2–7 mm. longis dermate silicoso minute papillato tandem deciduo obtectis; gynobasi excavata ca. 3 mm. alto et crasso.

PERU: Sandy places about Tacna, dept. Tacna, lat. 18° S., and on the drier interior slopes of the coastal hills at Cachendo, in the Mollendo region, dept. Arequipa, lat. 17° S. CHILE: Specimens are at hand from "Arica" but these may have been collected in the valley above Arica or about the Peruvian town of Tacna, for which Arica is the port.

SPECIMENS EXAMINED: Cachendo, 1000 m., Oct. 14, 16 and Nov. 28, 1923, *Guenther and Buchtien 115, 110* and *123* (Hamb.); frequent on a flooded place near Tacna, 650 m. alt., plant subprostrate or ascending, herbage fleshy, corolla sky-blue, Aug. 1925, *Werdermann 730* (TYPE, Gray Herb; BD); sandhill near Tacna, 800 m. alt., a small fugitive annual, leaves fleshy, corolla sky-blue, Aug. 1925, *Werdermann 723* (G, BD); bare sandy hills near Tacna, 900 m. alt., fleshy, corolla sky-blue, Oct. 1890, *Woitschach 98* (BD); common and ornamental in the sandy water-courses in the valley, Tacna, small bushy growths ca. 3 dm. broad and 1 dm. tall, leaves fleshy, corolla bright blue, May 1891, *Woitschach 99* (BD); Tacna, erect bushy annual, 3–4.5 dm. tall, corolla lilac, Sept. 1864, *Pearce* (K); Arica, Dec. 1880, *P. Ortiga* (G).

Obviously related to *N. spathulata* but smaller throughout and having the leaf bases rounded or angulate and not cordate or reniform. It occurs to the south of its relative and is a plant, not of the coast but of the interior. The epicarp of the mature nutlets is a fragile loose glossy shell that breaks up and falling away exposes the dull rough endocarp. Throughly mature fruit of *N. spathulata* has not been seen, but probably is similar in general structure to that of *N. arenicola*. The material I have cited from Cachendo has been reported as *N. prostrata* by Bruns, Mitt. Inst. Bot. Hamburg **8**: 72 (1929).

3. **Nolana latipes** sp. nov.

Herba annua depressa glabra vel inconspicue villulosa et glandulosa; caulibus laxe ascendentibus vel decumbentibus 1–3 dm. longis fistulosis 2–4 mm. crassis laxe ramosis; foliis glabris minute inconspicueque papillatis valde compressis oblanceolatis vel obovato-oblongis obscure costatis 7–18 mm. latis 2–4 cm. longis, paullo supra medium latioribus, basim versus gradatim attenuatis (vix evidenter petiolatis), 2–4 mm. late affixis, apice obtusis, margine planis; pedicellis ad anthesin 1–2 cm. longis ascendentibus, fructiferis plus minusve recurvatis vel deflexis 1.5–2.6 cm. longis; calycibus ad anthesin ca. 1.5 cm. longis 4–5 mm. crassis profunde bifidis inaequaliter 5-lobatis, lobis 2–5 mm. longis (apicibus in alabastris libris) ca. 1 mm. latis diadelphis et triadelphis; calycibus fructiferis conspicue divergenteque bipartitis; corolla coerulea infundibuliformi 1.5–2 cm. longa ca. 2 cm. diametro, tubo 1–1.5 mm. crasso 3–4 mm. longo intus dense villuloso; filamentis 3–6 mm. longis inaequalibus imam ad basim villosis; fructibus ca. 8 mm. crassis; nuculis nigris valde irregularibus rugosis angulatis ca. 10–20, majoribus saepissime 5 ca. 4 mm. longis facie interiore cicatricosis; receptaculo ca. 10-dentato, gynobasi 2–3 mm. crassa et alta conspicue 5-excavata ornato.

Peru: Known only from the region about Mollendo, dept. Arequipa, lat. 17° S.

Specimens examined: Mollendo, dry sandy places at lower edge of Loma Formation 20–200 m. alt., flowers bright blue, Oct. 3, 1902, *Weberbauer 1498* (type, herb. Berol.); Mollendo, *D. Safford K56* (K); Mejia, 30 m. alt., Oct. 23, 1923, *Guenther and Buchtien 114* (Hamb.); Cachendo, 650 m. alt., 1923, *Guenther and Buchtien 1568* (Hamb.).

This new species agrees with *N. pallidula* in having angulate, black, and very rugose nutlets. There are usually five large ones developed. These are attached broadly on their face and seated in sockets in the faces of the pyramidal gynobase. Smaller wedge-shaped nutlets are fitted in between, both above and below, the five principal nutlets. Material of this plant has been reported by Bruns, Mitt. Inst. Bot. Hamburg **8**: 72 (1929) as *N. paradoxa*.

4. **Nolana pallidula** sp. nov.

Planta glaberrima suffruticosa laxe decumbens 1–1.5 m. lata 1–1.5 dm. alta utvidetur annua; caulibus fistulosis succulentis laxe ascendenter ramosis 3–6 mm. crassis internodiis 1–6 cm. longis; foliis spathulatis vel angustissime oblanceolatis succulentibus 1.5–4 cm. longis 2–6 mm. latis papillis minutis abundantibus obtectis pallidulis paullo infra apicem in petiolum scarioso-marginatum ca. 2 mm. latum 2–9 mm. longum attenuatis apice late acutis; pedicellis ad anthesin 2 (1.5–3) mm. longis, fructiferis ascendentibus; corolla coerulea infundibuliformi 2–3 cm. longa ca. 18 mm. diametro, tubo intus dense villoso 5–6 mm. longo ca. 2 mm. crasso; filamentis 5–7 mm. longis linearibus compressis basim versus sparse villosis; calycibus carnosulis ad anthesin ca. 18 mm. longis ca. 6 mm. crassis 5-costatis inaequaliter 4–6 mm. longe 5-lobatis medium versus bifidis, lobis erectis; calycibus fructiferis per nuculas infra medium dilatatis mox disruptis; nuculis nigris lucentibus angulatis rugosis inaequalibus ca. 10–20, majoribus 4–5 mm. longis, minoribus inter basim majores affixis; receptaculo ca. 10-dentato gynobasi pyramidali ca. 3 mm. alta ornato.

PERU: Valley near Tacna, lat. 18° S.

SPECIMENS EXAMINED: Near Tacna, ca. 650 m. alt., flowers bright blue, loosely decumbent, forming patches 15 dm. broad, succulent, leaves silver gray, stems dark, Aug. 1925, *Werdermann 728* (TYPE, Gray Herb; BD); sand near Tacna, flowers dark blue, leaves very fleshy, plant becoming 15 cm. tall, Sept. 1890, *Woitschach* (BD); "Bolivia," annual, flowers blue, *Pearce 654* (K).

A loosely branched, sprawling, very succulent herb known definitely only from near Tacna. It is evidently related to *N. latipes* from the Mollendo region, but is a much more spreading and fleshy plant. The leaves are narrower, and have expanded scarious-margined bases. The calyx-lobes are fleshy with scarous margins. They are coarser and more rigid than in *N. latipes* and being erect and juxtaposed do not spread and reveal the clefting of the calyx as obviously as in that species.

5. **Nolana galapagensis** (Christoph.), comb. nov.

Periloba galapagensis Christophersen, Nyt Mag. Naturvid. **70**: 89 cum tab. (1932).—Indefatigable Island, *Rorud 15*.

ECUADOR: Known only from the Galapagos archipelago; Indefatigable, North Seymour, Brattle and Charles islands.

SPECIMENS EXAMINED: On rocks near the surf on North Seymour Island, densely branched broad shrub nearly a meter high, leaves thick and juicy, corolla white, June 12, 1932, *Howell 10002* (G, CA); rare on sand banks, Turtle Bay, Indefatigable Island, shrub 9 dm. tall, Jan. 1927, *B. Rorud 15* (US, ISOTYPE).

The nutlets of this species are biseriate. There are about 10 small nutlets, 1–2 mm. long, borne below the middle of the evident gynobase and 3–5 larger ones (2–2.5 mm. long) borne above them. The gynobase occupies much of the receptacle. It may be as thick as high or may be more or less distinctly compressed laterally.

In gross aspect, in habit of growth, in form of corolla, in fact, apparently in all details except the structure of its fruit, this plant suggests the Chilean species rather than the geographically nearer ones of Peru. The species is known only from the Galapagos Archipelago, just south of the Equator. It is by far the most northerly ranging species of the Family. Geographically the nearest relatives are *Nolana humifusa* and *N. laxa*, both of the department of Lima in west central Peru in latitude 11° 20′ and 11° 30′ S. According to Mr. J. T. Howell, in lit., this species was collected by Stewart in the Galapagos Islands in 1905–06. The collections from Brattle and Charles islands, were reported by Stewart, Proc. Calif. Acad. Sci. ser. 4, **1**: 65 (1911), as follows,—"Aizoacea (?) sp. Sterile specimens of bushes 4–5 ft. high with succulent leaves were collected on Brattle Isl. and on the beach at Cormorant Bay, Charles Isl. The family is doubtful (nos. 1494, 1495)."

6. **Nolana Gayana** (Gaud.) Koch

Alibrexia Gayana Gaudichaud, Bot. Voyage Bonite, Atlas tab. 105 (1851–52).—Type not indicated.

Nolana Gayana (Gaud.) Koch, Ind. Sem. Berol. **1855**: appendix pg. 12 (1855?); Johnston, Contr. Gray Herb. **85**: 156 (1929).

PERU: Coastal hills in the department of Lima to the south of the Capital; extending down the coast to the hills about Lurin, lat. 12° 20′ S.

SELECTED SPECIMENS: Barranco, in dry sandy places at the lower edge of the Loma Formation, 50–200 m. alt., flower blue, Oct. 1902, *Weberbauer 1606* (BD); Tablada de San Juan, Feb. 1874, *Martinet 287* (Paris); Tablada de Lurin, *Mathews 836* (K) and *837* (K, BM); Lurin, prostrate on the dryer seaward slopes of sandy hills, flowers lavender blue, ca. 60 m. alt., Sept. 1923, *Macbride 5937* and *5991* (G, FM, BD).

A very distinctive and quite local species having its closest relative, probably, in the geographically far removed *N. intonsa* of Chile. The fruit consists of about five sharply angulate major nutlets and several or more minor nutlets that are wedged in between the bases of the major ones. I am judging Gaudichaud's species entirely upon the published plate. Fortunately, however, the species is a very distinct one and Gaudichaud's admirable illustration of it is quickly recognizable. Until the type is located we may suppose that it was probably collected by Claudio Gay in the repeatedly botanized area about Lurin.

Miers, Hooker London Jour. Bot. **4**: 508 (1845) and Ill. So. Am. Pl. **1**: 61 (1850), and Dunal, in DC. Prodr. **13**[1]: 17 (1852), who followed him, have described our plant under the name, *Alibrexia revoluta*, a synonym of *Nolana revoluta* R. & P. The latter species, to judge from the poor illustration, differs from *N. Gayana* in its glabrous herbage, evidently veined leaves, short pedicels, and more slender and acuminate calyx-lobes. In addition it is said to have come from Camaná, in southern Peru.

7. **Nolana intonsa** sp. nov.

Planta herbacea gracilis pilis flexuosis 1–1.5 mm. longis villosa minute inconspicueque glandulosa; caulibus decumbentibus 1–2 mm. crassis laxe 5–15 mm. longeque ramosis, internodiis 3–20 mm. longis; foliis anguste spathulato-linearibus 2–3 cm. longis 1–2 mm. latis planis haud evidenter carnosis 5–10 mm. infra apicem latioribus deinde caulem versus gradatim attenuatis apice obtusis; pedicellis gracilibus ascendentibus 1–4.5 cm. longis; calyce ad anthesin ca. 1 cm. longo nullo modo angulato, tubo cupulato ca. 4 mm. diametro ca. 3 mm. profundo, lobis cuneatis erectis imam ad basim ca. 2 mm. latis apice longi-acuminatis; corolla in sicco subviolacea infundibuliformi ca. 2 cm. longa et lata, tubo ad 5 mm. longo ca. 1 mm. crasso intus pubescente; filamentis inaequalibus 4 et 6 mm. longis; fructu ignoto.

CHILE: Iquique, prov. Tarapacá, lat. 20° 13′ S., Oct. 1904, *P. Martens* (TYPE, Gray Herb.).

A species much suggesting the Peruvian *N. Gayana* in gross habit, but differing in having long-attenuate calyx-lobes and an indument of slender elongate simple hairs rather than of short stellate ones. It is known only from the type which was collected at one of the ports on the Nitrate Coast of northern Chile, and is separated from *N. Gayana* by a geographical hiatus of over 1200 kilometers. The type of *N. intonsa* is in flower only. The ovary at anthesis, however, is quite like that of its suggested relative. In my paper on the Flora of the Nitrate Coast, Contr. Gray Herb. **85**: 156 (1929), the present plant was listed incorrectly as representing good *N. Gayana*.

8. **Nolana sessiliflora** Phil.

Nolana sessiliflora Philippi, Anal. Univ. Chile **91**: 32 (1895); Reiche, Anal. Univ. Chile **125**: 491 (1910) and Fl. Chile **5**: 419 (1910).—Type collected in the Sierra Esmeralda by San Roman.

Nolana sessilifolia Philippi ex Johnston, Contr. Gray Herb. **85**: 105 (1929), lapsu calami.

Periloba sessiliflora (Phil.) Johnston, Contr. Gray Herb. **85**: 105 (1929).

CHILE: A species of the desert interior, 25–125 km. inland, in the southern parts of the province of Antofagasta.

Philippi described a specimen from the Sierra Esmeralda which was just coming into flower. Reiche had flowers and fruit and mentions collections from the Sierra Esmeralda, lat, 25° 50′ S., long. 70° 35′ W., and El Chaco, lat. 25° 27′ S. and long. 69° 15′ W. At Berlin I have studied a specimen from Santiago bearing the following data in Reiche's script,—"*Nolana sessiliflora* Ph., El Chaco, 29 I." The root and base of the stem of this species is unknown. It is probably an erect annual herb.

The fruit consists of about 10 erect nutlets arranged more or less evidently in two series. The gynobase is pyramidal and at least 1–2 mm. high and thick. The nutlets are obliquely and suprabasally attached. They are black and obscurely rugulose, consisting of five major ones, 3–4 mm. long, and 3–5 minor ones, 2–3 mm. long. The minor nutlets form the outer series, being wedged in between the bases of the major nutlets and joined only about the basal corners of the pyramidal gynobase.

In the specimen at Berlin the calyx becomes 16 mm. long and fully 10 mm. broad at the abruptly expanded base. The lobes are unequal, and joined only 2 mm. above the pedicel. The largest one is 4–5 mm. broad towards the base but is contracted and becomes ligulate and 2–2.5 mm. broad above the middle. The apex is quite obtuse. The short lobes are 10–12 mm. long. The herbage of the plant is minutely stipitate-glandular. It is not pubescent.

9. **Nolana parviflora** (Phil.) Phil.

Sorema parviflora Philippi, Fl. Atac. 44 and Viage Des. Atac. 10, 218 (1860).—Type collected at Caldera by Philippi.

Nolana parviflora (Phil.) Philippi, Anal. Univ. Chile **91**: 29 (1895).

Periloba parviflora (Phil.) Johnston, Contr. Gray Herb. **85**: 105 (1929).

Nolana parviflora Philippi, Anal. Univ. Chile **91**: 34 (1895); Reiche, Anal. Univ. Chile **125**: 494 (1910) and Fl. Chile **5**: 422 (1910).—"Prope Bandurrias invenit orn. Guill. Geisse; prope Caldera sat frequens."

CHILE: Sandy places in the province of Atacama, from Caldera south to Bandurrias, lat. 27° to 27° 50′ S.

MATERIAL EXAMINED: Rather common in fog-bathed area near Monte Amargo, ca. 200 m. alt., annual, corolla small and white, Oct. 1924, *Werdermann 460* (G, BM, BD); Caldera, *ex Philippi* as *N. parviflora* (US, K); Chile, *Philippi* (BD); Atacama Desert, *Morong 1167* and *1272* (NY).

A decumbent annual with small inconspicuous white corollas. The nutlets in size and surface-markings much suggest those in *N. baccata.* They are, however, not so angular as in that species being more plump and having an evident medio-longitudinal keel. About the apex of the nutlets the keel is frequently drawn out into a narrow erect wing. The nutlets in *N. parviflora* number 10–15 and because of their more plump form are not so closely fitted together as in *N. baccata.* Only two ill defined series of nutlets are discernible in the fruit.

10. **Nolana pterocarpa** Phil.

Nolana pterocarpa Philippi ex Wettstein in Engler and Prantl, Nat. Pflanzenfam. iv. **3b**: 3 (1891); Post and Kunze, Lexicon 390 (1904).—Type not cited, but probably a duplicate of the following species.

Nolana pterosperma Philippi, Anal. Univ. Chile **91**: 27 (1895); Reiche, Anal. Univ. Chile **125**: 493 (1910) and Fl. Chile **5**: 421 (1910).—Type collected between Caldera and Copiapó, in Sept. 1885, by F. Philippi.

Periloba pterosperma (Phil.) Johnston, Contr. Gray Herb. **85**: 105 (1929).

Nolana debilis Philippi, Anal. Univ. Chile **91**: 29 (1895); Reiche, Anal. Univ. Chile **125**: 493 (1910) and Fl. Chile **5**: 421 (1910).—Type from Piedra Colgada.

Nolana pulchella Philippi ex Reiche, Anal. Univ. Chile **125**: 493 (1910) and Fl. Chile **5**: 421 (1910).—Published in synonymy of *N. debilis.*

Chile: Sandy places in the Caldera—Copiapó area, prov. Atacama, lat. 27° to 27° 30′ S.

Specimens examined: Sand in quebrada just northwest of Copiapó, 370 m., decumbent annual with blue corollas, Nov. 1925, *Johnston 5029* (G); Queb. Chanchoquin near Copiapó, Sept. 1885, *Gigoux* (G); Piedra Colgada, Sept. 1885, *ex Philippi* as *pterocarpa* (BD, BM); Caldera, *ex Philippi* as *N. debilis* (US, K, BD).

The fruit of this species consists of 5–10 major nutlets (4–6 mm. long) and fewer smaller ones wedged in between and fixed on the edge of the receptacle slightly below and outside the major ones. The black nutlets are laterally compressed and somewhat lenticular. The lateral faces are convex. The medio-longitudinal margin, except in the quarter occupied by the nutlet-attachment, is drawn out into an evident knife-like wing averaging ca. 1 mm. in width. Kuntze, l. c., appears to have been much impressed with this development and proposed the section *Pteronolana* for this species. The wing on the nutlets of *N. pterocarpa,* however, is merely an extreme development of a tendency well marked in the nutlets of *N. parviflora.*

Young plants of *N. pterocarpa* are strikingly similar to flowering juvenal forms of *N. baccata* and are frequently separated from them only with difficulty. The corollas in *N. pterocarpa,* however, are less deeply lobed than in *N. baccata* and the leaves tend to have a very much more broadly inrolled margin.

There is an unfortunate name-change required for this species. Philippi appears to have distributed duplicates of the original collection before he had published his name for them. There are reasons to believe that Wettstein, finding this distinct plant in the herbarium, proceeded to use Philippi's tentative herbarium-name without first determining whether its author had previously published it. In finally proposing the species, four years later, Philippi seems to have altered the specific epithet. Wettstein's use of Philippi's herbarium-name is in a synoptical key where it has just enough descriptive matter to make it validly published. *Nolana pterocarpa* Phil. ex Wettst. is accordingly taken up. It is treated as practically an exact synonym of the subsequently well described *N. pterosperma* Ph.

11. **Nolana baccata** (Lindl.) Dunal

Alona baccata Lindley, Bot. Reg. **30:** sub tab. 46 (1844); Gay, Fl. Chile **5:** 111 (1849); Reiche, Anal. Univ. Chile **125:** 500 (1910) and Fl. Chile **5:** 428 (1910).—Type collected by Bridges, no. 1322; originally given as from Coquimbo but in fact from between Copiapó and Huasco.

Nolana baccata (Lindl.) Dunal in DeCandolle, Prodr. **13**[1]: 14 (1852).

Periloba baccata (Lindl.) Johnston, Contr. Gray Herb. **85:** 105 (1929).

Gubleria baccata [? Lindl.] Gaudichaud, Bot. Voyage Bonite, Atlas tab. 104 (1851–52).

Sorema linearis Miers in Hooker, London Jour. Bot. **4:** 499 (1845) and Ill. So. Am. Pl. **1:** 52 (1850); Gay, Fl. Chile **5:** 106 (1849).—Type given as collected at Concepcion by Bridges, no. 1323; in fact from between Copiapó and Huasco and really Bridges no. 1322.

Nolana linearis (Miers) Miers ex Dunal in DeCandolle, Prodr. **13**[1]: 13 (1852); Reiche, Anal. Univ. Chile **125:** 490 (1910) and Fl. Chile **5:** 418 (1910).

? *Nolana Navarri* Philippi, Anal. Univ. Chile **91:** 30 (1895); Reiche, Anal. Univ. Chile **125:** 492 (1910) and Fl. Chile **5:** 420 (1910).—Type-material collected at the port of Tongoi by L. Navarro and near Carrizal by G. King.

Nolana stans Philippi, Anal. Univ. Chile **91:** 31 (1895); Reiche, Anal. Univ. Chile **125:** 488 (1910) and Fl. Chile **5:** 416 (1910).—Type collected at Piedra Colgada.

Periloba stans (Phil.) Johnston, Contr. Gray Herb. **85:** 105 (1929).

Nolana Carrera Philippi, Anal. Univ. Chile **91:** 31 (1895); (*N. carrerae*) Reiche, Anal. Univ. Chile **125:** 492 (1910) and Fl. Chile **5:** 420 (1910).—Type-material from near Copiapó and Huasco.

Nolana alba Philippi, Anal. Univ. Chile **91:** 32 (1895).—Type-material cited, "Primum de Bandurrias prope Chañarcillo a Guilielmo Geisse accepi, prope Caldera frequens."

Nolana leucantha Philippi, Anal. Univ. Chile **91:** 34 (1895).—Type collected by Geisse near Caldera.

Nolana Carrerae var. *leucantha* (Phil.) Reiche, Anal. Univ. Chile **125:** 492 (1910) and Fl. Chile **5:** 420 (1910).

CHILE: Sandy places in the province of Atacama; known definitely from along the coast, from Caldera to Carrizal, and inland to Piedra Colgada and Bandurrias, lat. 27° to 28° 10′ S. Beyond this range it has been reported from between Paposo and Taltal, from about Huasco, and from the provinces of Coquimbo and Aconcagua.

SPECIMENS EXAMINED: Sandy plains and hills between Copiapó and Huasco, annual ca. 15 cm. tall, flowers white, *Bridges 1322* (Lindl.); "Conception, *Bridges 1323*" (K); fog-bathed area near Monte Amargo, ca. 200 m. alt., corolla white or rarely bluish, plant somewhat viscid, Oct. 1924, *Werdermann 444* (G, BD); vicinity of Caldera, *Gigoux* (G); Atacama Desert, *Morong 1137* and *1373* (NY); Atacama, *ex Philippi* as *N. Carrerae* (US, BD, K); Atacama Desert, *Geisse 13* (NY); Piedra Colgada, Sept. 1885, *Philippi* as *N. stans* (BM); Atacama, *ex Philippi* as *N. stans* (K, BD); Carrizal, 1885, *King* as *N. Navarri* (BD).

The types of *Alona baccata* Lindl. and *Sorema linearis* Miers are duplicates of a collection made by Bridges! A study of Bridges manuscript plant-list shows conclusively that both types should bear Bridges' no. 1322 and that both specimens came from between Copiapó and Huasco. Miers has cited this number as 1323, but that properly belongs to the type-collection of *Alona ericifolia*, a synonym of *Alona coelestis!* Philippi's *N. alba* and *N. leucantha* are evident synonyms of *N. baccata*. All three of these species are based upon the common form of this plant having white corollas and very glandular herbage. Philippi's *N. stans* seems to be an uncommonly smooth and sparsely glandular form. *Nolana Navarri* Phil., at least in part, is like the common typical form of *N. baccata*, but has bright blue corollas. *Nolana Carrera* Phil. is described as having corollas which are a beautiful blue with white in the throat, though as having "una variedad con flores enteramente blancas". In his field notes, appended on the sheet of his collection no. 444 at Berlin, Werdermann states that the corolla is "weiss, selten blaulich." It seems, therefore, that though *N. baccata* has prevailingly white flowers it occasionally, at least, may have blue or bluish ones as well.

Philippi's *N. Navarri* is given as based upon material collected by Navarro, near Bahia de Tongi, prov. Coquimbo, lat. 30° 15′ S., and by King at Carrizal. There is a specimen at Berlin from Philippi labeled *N. Navarri* and as collected at Carrizal by King. It is the blue-flowered form of *N. baccata*. Unfortunately I have seen no material collected by Navarro. Since the species is named for him it is logical to treat his collections as type of the species. The fact that Navarro's collections came from Tongoi Bay to the south of the port of Coquimbo and far to the south of the indubitable range of *N. baccata* makes me feel that his collection probably represents another species, perhaps even *N. acuminata.*

It is perhaps unnecessary to note that the fruit of *N. baccata* is not baccate. It consists of 20–25 small (mostly 1–2.5 mm. thick) irregularly angulate and polyhedral nutlets that are closely fitted in 2–3 very ill defined ranks to form a globose mass ca. 5 mm. in diameter. The individual nutlets are angular and lacunose and no more baccate than in other congeners. Gaudichaud illustrates the nutlets as irregularly lobed or with a well developed horizontal wing encircling their middle. I greatly doubt the accuracy of these details on this otherwise admirable plate. All collections examined by me have the simple angulate, irregularly polyhedral nutlets described. Bridges collection (no. 1322) of this species was no doubt available to Gaudichaud, and in all probabilities was the only one, and, hence, almost certainly that illustrated by him. I have found no suggestion of winged nutlets in any of the several duplicates of this collection examined by me.

In the British Museum there is a specimen, which may represent *N. baccata,* that is accompanied with a label giving it to be *Cuming 856* from "Coquimbo." The specimen is a small annual herb showing basal leaves and flowers but no fruit. I am not only unable to identify the plant with certainty but furthermore must question its data. The number given is that of the type-collection of *Sorema lanceolata* Miers which is certainly a different plant.

12. **Nolana Jaffuelii** sp. nov.

Herba annua glaberrima eglandulosa; caulibus pluribus decumbentibus 1–3 dm. longis simplicibus vel sparse laxeque ramosis fistulosis 2–3 mm. crassis; foliis medio-costatis aliquantum succulentis ubique vesiculis minutis ornatis; foliis basalibus vix persistentibus oblanceolatis conspicue petiolatis, lamina 8–15 mm. latis 3–6 cm. longis apice obtusis infra medium in petiolum 2–4 mm. longum gradatim attenuatis; foliis caulinis mediis et superioribus oblique lateque sessilibus conspicue decurrentibus haud auriculatis, lamina oblonga lanceolata vel ovata 2–4 mm. longa 6–12 mm. lata; pedicellis floriferis 1–3 cm. longis, fructiferis rigidioribus ascendentibus; calycibus ad anthesin 8–10 mm. longis angulatis, tubo 5–6 mm. crasso ca. 3 mm. profundo infra sinus plicato, lobis triangularibus acuminatis, fructiferis ca. 1 cm. crassis; corolla infundibuliformi coerulea 13–20 mm. longa calyce longiore et saepissime duplo longiore; filamentis inaequalibus; nuculis ca. 3-seriatis 1–3 mm. crassis pallidis angulatis lacunosis.

Chile: Gravelly slopes on the coastal hills in the provinces of

Tarapacá and Antofagasta, lat. 19° 50′ south to 22° 5′ S. PERU: Near Tacna.

SPECIMENS EXAMINED: Caleta Buena, 1902, *Paessler* (BD); Iquique, Nov. 1914, *Rose 19448* (US, NY); Quebrada de Huantajaya, Iquique, ca. 700 m. alt., Sept. 1925, *Werdermann 757* (G, BD); lomas, Iquique, 900 m., *Bollaert* (BM); gravelly slope in hills near Tocopilla, somewhat fleshy herb, decumbent, flowers blue, Oct. 18, 1925, *Johnston 3604* (TYPE, Gray Herb.); Tocopilla, Oct. 1930, *Jaffuel 1004, 1035* and *1036* (G). PERU: Hills near Tacna, one plant, prostrate annual, leaves with watery pustules, flowers blue, Sept. 1864, *Pearce* (BM).

A well marked plant probably most closely related to *N. elegans* of the fertile slopes in the Paposo region. From that species, however, it is quickly separable by being an annual herb, smaller throughout and quite glabrous. From *N. acuminata,* forms of which have been collected at least as far north as Antofagasta, it is separated at once by its conspicuously decurrent upper leaves and quite glabrous herbage. In my report on the flora of the Nitrate Coast, Contr. Gray Herb. **85:** 156 (1929), I treated this species as a form of *Periloba longifolia.*

13. **Nolana elegans** (Phil.) Reiche

Sorema elegans Philippi, Fl. Atac. 43 (1860) and Viage Des. Atac. 16, 17, 25, 38, 217 (1860).—Type collected by Philippi in hills above Paposo.

Nolana elegans (Phil.) Reiche, Anal. Univ. Chile **125:** 487 (1910) and Fl. Chile **5:** 415 (1910).

CHILE: On rich fog-bathed slopes of the coastal hills from the Paposo region north to about Miguel Diaz, prov. Antofagasta, lat. 24° 35′ to 25° 5′ S.

SPECIMENS EXAMINED: El Rincon near Paposo, succulent herb of the fertile belt, prostrate or clambering through bushes, corolla blue, Dec. 1925, *Johnston 5511* (G); grassy slopes in fertile belt above Ag. Miguel Diaz, decumbent rather succulent herb, Dec. 1925, *Johnston 5383* (G).

The type of this species was collected by Philippi on the fog-bathed slopes near Paposo. It is a conspicuous and beautiful plant with the rich blue corollas becoming 5 cm. long. The upper cauline leaves are obliquely sessile and, on one side only, have a conspicuous attenuate decurrent base becoming a centimeter long.

14. **Nolana rupicola** Gaud.

Nolana rupicola Gaudichaud, Bot. Voyage Bonite, Atlas tab. 28 (1841); Dunal in DeCandolle, Prodr. **13**[1]: 10 (1852).—Type not designated.

Alona longifolia Lindley, Bot. Reg. **30:** sub tab. 46 (1844).—Type collected at Coquimbo by Cuming, no. 887.

Sorema longifolia (Lindl.) Miers, Hooker London Jour. Bot. **4:** 498 (1845) and Ill. So. Am. Pl. **1:** 52 (1850); Gay, Fl. Chile **5:** 106 (1849).

Nolana longifolia (Lindl.) Miers ex Dunal in DeCandolle, Prodr. **13**[1]**:** 12 (1852); Reiche, Anal. Univ. Chile **125:** 491 (1910) and Fl. Chile **5:** 419 (1910).

Periloba longifolia (Lindl.) Johnston, Contr. Gray Herb. **85:** 104 and 156 (1929).

? *Nolana triquetra* Koch and Bouché, Ind. Sem. Hort. Berol. **1855:** appendix pg. 12 (1855?).—Based upon garden material probably grown from seeds collected in northern Chile by Philippi in 1853–54.

Sorema bracteosa Philippi, Fl. Atac. 43 (1860) and Viage Des. Atac. 217 (1860).—Type collected at Cachinal de la Costa by Philippi.

Nolana bracteosa (Phil.) Reiche, Anal. Univ. Chile **125:** 489 (1910) and Fl. Chile **5:** 417 (1910).

Sorema glutinosa Philippi, Fl. Atac. 44 (1860) and Viage Des. Atac. 10, 218 (1860).—Type collected near Caldera by Philippi.

Nolana glutinosa (Phil.) Reiche, Anal. Univ. Chile **125:** 489 (1910) and Fl. Chile **5:** 417 (1910).

Sorema lanceolata sensu Gaudichaud, Bot. Voyage Bonite, Atlas tab. 102 (1851–52).

? *Nolana lanceolata* sensu Hooker, Bot. Mag. **88:** tab. 5327 (1862).

CHILE: Rocky places near the coast, from the prov. Aconcagua north to the southern boundary of the prov. Antofagasta, lat. 33° to 26° S.

SELECTED SPECIMENS: Valparaiso, 1832, *Gaudichaud* (Del.); Coquimbo, *Werdermann 112* (G); Coquimbo, *Cuming 887* (K); Huasco, *Jaffuel 1182* (G); Caldera, *Gigoux 30* (G); Chañaral, rocky places on fog-bathed crest, perennial with decumbent stems, *Johnston 4768* (G); headlands near Aguada Grande (i.e. Cachinal de la Costa), 1925, *Johnston 5770* (G).

The present plant is evidently related to *N. acuminata* and has a range very similar to that species. It is, however, a coarser plant which tends to have a shrubby perennial base. The herbage is abundantly stipitate glandular, as well as frequently short hairy. This glandularity makes the herbage of *N. rupicola* a duller green than in its more hairy, but much less glandular or even quite glandless relative. The coarser leaves in *N. rupicola* are, also, not only more elongate and strap-shaped than in *N. acuminata,* but furthermore tend to have a subauriculate somewhat amplexicaul base. In *N. acuminata* the bases are not rounded off but, instead, abruptly short-decurrent. Our species appears to be a plant of fog-bathed cliffs and rocky places along the coast. Its relative seems to be an annual herb frequenting sandy or gravelly locations. The nutlets of *N. rupicola* are indistinguishable from those of *N. acuminata.* They are 1–3 mm. long and more or less angulate and somewhat lacunose. The pericarp is thin.

15. **Nolana acuminata** Miers

Sorema acuminata Miers, Hooker London Jour. Bot. **4**: 370 (July 1845) and Ill. So. Am. Pl. **1**: 51 (1850); Gay, Fl. Chile **5**: 105 (1849).—Type originally cited "ad Concepcionem (v. s. in Herb. Hook, no. 1322)," but actually *Bridges 1325* from near coast at Coquimbo.

Nolana acuminata (Miers) Miers ex Dunal in DeCandolle, Prodr. **13**[1]: 12 (1852); Reiche, Anal. Univ. Chile **125**: 491 (1910) and Fl. Chile **5**: 419 (1910).

Sorema lanceolata Miers, Hooker London Jour. Bot. **4**: 498 (Sept. 1845) and Ill. So. Am. Pl. **1**: 51 (1850); Gay, Fl. Chile **5**: 105 (1849).—Type from Coquimbo, *Cuming 856.*

Nolana lanceolata (Miers) Miers ex Dunal in DeCandolle, Prodr. **13**[1]: 12 (1852); Reiche, Anal. Univ. Chile **125**: 490 (1910) and Fl. Chile **5**: 418 (1910).

? *Nolana angustifolia* Philippi, Linnaea **29**: 26 (1857); Reiche, Anal. Univ. Chile **125**: 488 (1910) and Fl. Chile **5**: 416 (1910).—Type collected near Coquimbo by Gay.

? *Nolana rupestris* Philippi ex Wettstein in Engler and Prantl, Nat. Pflanzenfam. iv. **3b**: 3, fig. 1 (1891); Philippi, Anal. Univ. Chile **91**: 28 (1895); Reiche, Anal. Univ. Chile **125**: 489 (1910) and Fl. Chile **5**: 417 (1910).—Type collected at Curauma near Valparaiso.

Nolana napiformis Philippi, Anal. Univ. Chile **91**: 30 (1895); Reiche, Anal. Univ. Chile **125**: 488 (1910) and Fl. Chile **5**: 416 (1910).—Type-material collected by Philippi near Coquimbo and La Serena.

Nolana grandiflora Herzog, Meded. Rijks Herb. **29**: 21 (1916); not Lehmann (1837).—Type collected near Antofagasta, *Herzog 2457.*

Sorema longifolia sensu Gaudichaud, Bot. Voyage Bonite, Atlas tab. 103 (1851–52).

Chile: Gravelly places near the coast from the Valparaiso region north to the vicinity of Antofagasta, lat. 33° to 23° 30′ S.

Selected specimens: Limari, Fray Jorge, 100 m. alt. *Werdermann 893* (G); Coquimbo, *Cuming 856* (K); near coast, Coquimbo, *Bridges 1325* (K); Carrizal bajo, *King* (K); Chañaral on hillside, *Johnston 4769* (G); Taltal, 100 m., *Werdermann 769* (G); Antofagasta, *Johnston 3638* (G).

Although the type-specimen of *N. acuminata* bears Bridges' number 1322, a study of the collector's catalogue makes it evident that the number should be 1325 and that it was collected near the coast at Coquimbo. Neither this specimen, nor *Cuming 865*, which is the type of the apparently synonymous *S. lanceolata*, show the root.

This is unfortunate since some plants of the present species from the coast of Coquimbo have coarse, corky, carrot-like roots. Philippi's *N. napiformis* is such a plant. I have a strong suspicion that the underground parts of the type of *N. lanceolata* were also similarly thickened. Some material from Coquimbo, however, and practically all that from farther north, has normal slender fibrous roots. There are usually 10–15 nutlets developed. These are usually angular and wedged in and closely fitted together in about 2 ill-defined series. The northern collections of this species appear to have somewhat fewer and less roughened nutlets than do those from the south.

The plants I have treated under the names *N. rupicola* and *N. acuminata* are variable and have an uncommonly wide distribution. I shall not be surprised if they prove to be aggregates composed of critical species of limited distribution. Their present treatment is confessedly unsatisfactory. A careful study of them, particularly in the field, is much needed.

16. **Nolana paradoxa** Lindl.

Nolana paradoxa Lindley, Bot. Reg. **10**: tab. 865 (1825) and Trans. Hort. Soc. **6**: 296 (1826); Sims, Bot. Mag. **52**: tab. 2604 (1825), plate only; Dunal in DeCandolle, Prodr. **13**[1]: 11 (1852); Guppy, Observ. Naturalist in the Pacific **2**: 477 and 596 (1906); Reiche, Anal. Univ. Chile **125**: 486 (1910) and Fl. Chile **5**: 414 (1910).—Based upon garden material raised from Chilean seed received from Miers.

Periloba paradoxa (Lindl.) Rafinesque, Fl. Tellur. **4**: 87 (1838); Johnston, Contr. Gray Herb. **85**: 105 (1929).

Sorema paradoxa (Lindl.) Lindley, Bot. Reg. **30**: sub. tab. 46 (1844); Miers, Hooker London Jour. Bot. **4**: 369 and 502 (1845) and Ill. So. Am. Pl. **1**: 49, tab. 10 (1850); Gay, Fl. Chile **5**: 103 (1849).

Nolana atriplicifolia D. Don ex Sweet, Brit. Fl. Garden, ser. 2, **4**: tab. 305 (1835); G. Don, Gen. Syst. **4**: 479 (1837); Gay, Fl. Chile **5**: 104 (1849); Dunal in DeCandolle, Prodr. **13**[1]: 11 (1852); Reiche, Anal. Univ. Chile **125**: 487 (1910) and Fl. Chile **5**: 415 (1910); Saunders, Jour. Genetics **29**: 387–419, tab. 33, fig. 1–6 (1934).—Based upon garden material.

Sorema atriplicifolia (D. Don) Lindley, Bot. Reg. **30**: sub tab. 46 (1844); Miers, Hooker London Jour. Bot. **4**: 369 (July 1845).

Sorema paradoxa var. β *atriplicifolia* (D. Don) Miers, Ill. So. Am. Pl. **1**: 50 (1850).

Nolana grandiflora Lehmann ex G. Don, Gen. Syst. **4**: 479 (1837).—In synonymy of *N. atriplicifolia*.

Sorema litoralis Miers, Hooker London Jour. Bot. **4**: 370 (July 1845) and Ill. So. Am. Pl. **1**: 50 (1850); (*S. littoralis*) Gay, Fl. Chile **5**: 104 (1849); Philippi, Linnaea **33**: 207 (1864).—Original material from

Valparaiso, collected by Mathews, Cuming (no. 627) and Bridges (no. 327).

Nolana littoralis Miers ex Dunal in DeCandolle **13**[1]: 12 (1852).

? *Nolana paradoxa* β *glaberrima* Dunal in DeCandolle, Prodr. **13**[1]: 11 (1852).—Type given as "v. v. in hort. Monsp."

Nolana atriplicifolia β *cuneifolia* Dunal in DeCandolle, Prodr. **13**[1]: 12 (1852).—Type collected near Quintero by Bertero, no. 1183.

Nolana paradoxa var. *violacea* Van Houtte, Fl. des Serres **13**: 7, tab. 1294 (1858).—A garden color-form.

Nolana atriplicifolia var. *subcorulea* hort., Floral Mag. **2**: tab. 128 (1862).—A horticultural color-form.

Sorema petiolata Philippi, Linnaea **33**: 207 (1864).—Type from near Corral.

Nolana petiolata (Phil.) Reiche, Anal. Univ. Chile **125**: 493 (1910) and Fl. Chile **5**: 421 (1910).

Nolana ochrocarpa Philippi ex Wettstein in Engler and Prantl, Nat. Pflanzenfam. iv. **3b**: 3, fig. 1 (1891); Philippi, Anal. Univ. Chile **91**: 33 (1895); Reiche, Anal. Univ. Chile **125**: 486 (1910) and Fl. Chile **5**: 414 (1910).—Type from San Vicente near Talcahuano.

Nolana geminiflora Philippi, Anal. Univ. Chile **91**: 27 (1895).—Type collected at Algarrobo in April 1881.

CHILE: Coastal sands from Quintero, prov. Aconcagua, lat. 32° 45′ S., along the seashore south to the Island of Chiloe, ca. lat. 42° 40′ S., and, according to Reiche, along Chilean Patagonia to the mouth of the Rio Aysen, lat. 45° 20′ S. Reiche reports it "desde la provincia de Coquimbo hasta la boca del rio Aysen; en el interior hasta Quillota" Quillota is 25 km. up the Aconcagua Valley.

This species was the second member of the Nolanaceae to reach European gardens. The original seeds were sent Francis Place by John Miers, then in Chile, and appear to have been received about 1822. They were almost certainly collected on the sea-shore at Concon, near where Miers resided in Chile.

The plant is notable for several peculiarities of habit. Ranging along the whole coast of central Chile south to Chiloe and even somewhat beyond, it is the sole member of the family south of the Valparaiso area. The species, hence, sets the southern limit in the area of dispersal of the Nolanaceae. Although the members of the family practically all occur near, along, or at least at no great distance from the sea, only two species have selected the sandy sea-shore as habitats. These are *Nolana thinophila*, local in southern Peru, and *Nolana paradoxa*, widely distributed along central Chile. The latter is evidently the more successful and has various characteristic adaptations for the strand habitat and tidal dispersal. It has a deep fleshy tap-root. The elongate stems are prostrate and freely and loosely branched.

The herbage is quite succulent. The plant roots readily in gardens and it is quite probable that the readily detached branches of the plant, washed about by the waves and currents probably aid in the dispersal of the plant through this vegetative means. The nutlets are provided with a thick corky epicarp. The buoyant nature of these nutlets, and the ease with which detached leafy stems can be spread by ocean currents, lead one to wonder, in fact, why *N. paradoxa* has not even a wider distribution along the coastal sands.

The nutlets have rounded angles and are 3–6 mm. long. The faces are nearly smooth. In all mature specimens from wild plants examined by me, the nutlets have a conspicuous corky pericarp. Such writers as Guppy, Obs. Nat. Pacific **2**: 477 and 596 (1906), and Miers, Hooker London Jour. Bot. **4**: 369 (1845), who have studied the plant on the Chilean beaches, both report the corky pericarp as normal for the species. Philippi, however, described it as characteristic of his newly proposed *N. ochrocarpa*. While I believe we may safely assume that the corky nutlets of *N. paradoxa* are characteristic of that species under normal conditions, it must be noted that in garden material the nutlets are not only smaller but also tend to have the corky layer poorly developed.

This species, along with the Peruvian *N. humifusa* (= *N. prostrata*) has been the subject of breeding experiments by Miss Saunders, Journ. Genetics **29**: 387–419 (1934). Certain matters of concept and nomenclature in her interesting paper, however, need some comment. For the present Chilean species she has accepted the name "*N. atriplicifolia*," for some reason attributing the name to "hort." although admitting that it was proposed by Don. Her usage of the name "*N. paradoxa*" is involved. There is the original "*N. paradoxa* Lindl." which was described and illustrated in the Botanical Register (tab. 865) and there is the "*N. paradoxa* Hook." which she sometimes applies to the plate (tab. 2604) in the Botanical Magazine (which is good *N. paradoxa* Lindl.), and sometimes to the plant discussed in the text accompanying plate 2604 (which is *N. tenella* Lindl.). She finally concludes that not only *N. tenella* Lindl., but both of her usages of *N. paradoxa* apply to simple or complex natural hybrids of *N. atriplicifolia* and *N. prostrata*.

The plant illustrated on plate 2604 of the Botanical Magazine was drawn May 1823 from plants obtained from Place who had imported them from Miers in Chile. Since Place's importations were made about 1822 and were the first of our Chilean plant made into Europe, it is evident that the *Nolana* was illustrated during its first or second growing season in England. Lindley's plate, accompanying the original description of *N. paradoxa*, was based upon plants growing in 1824, which had also been obtained from Place. Concerning these two plates I believe that, whatever differences there are between them, they represent plants, slightly modified by cultivation, from the same, then very recent importations by Place, and that they originated in central Chile and in all probability near Concon where Miers then resided. Could these plants have been natural or even garden hybrids of the Chilean plant and the Peruvian *N. humifusa?*

There are several difficulties in the acceptance of Miss Saunders' theory of the hybrid origin of *N. paradoxa*. Any possibility of it being a natural hybrid of the Chilean plant and *N. humifusa* is quickly eliminated. Not only do the two supposed parents have very different habitats, one affecting coastal beaches and the other the fog-bathed middle and upper slopes of the coastal hills, but they have widely dissevered ranges as well, being separated by at least 2500 km. (1500 miles) and over 18 degrees of latitude. The literary sources from which Miss Saunders found reason for believing the two species have over lapping ranges are simply incorrect! Miss Saunders states that *N. atriplicifolia* is a pure species and one of the parents, in a natural cross with *N. humifusa*, that gave rise to *N. paradoxa*. A study of the history of *N. atriplicifolia*, however, casts further doubt on this hypothesis. The supposed parent is definitely stated to have been introduced into England from "Peru" in 1834, that is to say over a decade subsequent to the appearance of its supposed hybrid, *N. paradoxa*. Since the possibilities that *N. paradoxa* was a wild hybrid have been completely eliminated, and since true *N. atriplicifolia* Don has been shown to have been not available for a chance garden hybrid with *N. humifusa* when *N. paradoxa* first appeared in England, we are forced to one of two conclusions. Either the plants illustrated as *N. paradoxa* were pure strains of the Chilean plant (as *N. atriplicifolia* is assumed to be by Miss Saunders), or they represent chance garden hybrids of the Peruvian, *N. humifusa*, and a pure strain of the Chilean plant, in the two or three years subsequent to Place's introduction of the latter into English gardens. I am of the opinion that the first alternative is correct.

Miss Saunders has demonstrated that *N. tenella* Lindl. is a hybrid of the Chilean plant and the Peruvian *N. humifusa*. She has remarked, however, that the two parents are readily self-fertile but that "When bred together they show a very high degree of sterility. Out of many dozens of cross-fertilizations . . . only five yielded viable seeds

. . ." The hybrid, *N. tenella*, is the uniform recurrent progeny of the reciprocal crosses of the Chilean and Peruvian species. This F_1, beautifully illustrated by Miss Saunders, is very different from *N. paradoxa* and not to be at all confused with it. She believes, therefore, that *N. paradoxa*, is a "derivative of the mating of atriplicifolia ♀ × prostrata ♂" and the result of several generations of back breeding with *atriplicifolia*. The belief of Miss Saunders that *N. paradoxa* was heterozygous might be accepted were there any possibilities that it might have been a wild hybrid. But with this eliminated her theory demands a complex garden hybrid and that, while barely within the realms of possibility, actually seems incredible when one considers the very few years it had been in cultivation before Lindley described and illustrated this supposed hybrid. Miss Saunders has remarked on the resistance of the two supposed parents to crossing, and this under the determined supervision of an interested geneticist. This physical handicap to chance crossing and the improbability of a newly imported Chilean plant, a novelty, being bedded at once with the then long known and though not widely cultivated species from Peru, makes the possibilities of a simple, not to mention a complex chance garden hybrid during the first few years subsequent to Place's introductions seem very remote indeed. Finally what seems positively incredible is that the editors of the Botanical Register and the Botanical Magazine would have passed over the only recently introduced pure Chilean plant, horticulturally an attractive one and botanically a most curious species, and centered their whole attention on what could have been at most only one or two chance hybrids scarcely separable from it. The plates in the Botanical Register and the Botanical Magazine represent, I believe, the pure Chilean stock uncontaminated by hybridization. The name *Nolana paradoxa* Lindl. is the correct and proper name for the well known species of the coast of central Chile.

17. **Nolana Adansoni** (R. & S.), comb. nov.

Tula Adansoni Roemer and Schultes, Syst. **4**: 355 (1819); DeCandolle, Prodr. **4**: 418 (1830); G. Don, Gen. Syst. **3**: 524 (1834).—Based on the following polynomial.

Soldanella facie, flore infundibuli forma, Feuillée, Jour. Observ. Phys. **2**: 15 (1725) and **3**: [Hist. Pl. Medicinal] 63, tab. 44 (1725).—Original specimens collected on coast just south of Ilo, Peru, by Feuillée.

Sorema cordata Remy, Ann. Sci. Nat. ser. 3, **6**: 351 (1846).—Type collected at Islay by d'Orbigny.

Nolana cordata (Remy) Dunal in DeCandolle, Prodr. **13**[1]: 13 (1852); Weberbauer in Engler and Drude, Veg. Erde **12**: 137, fig. 7a (1911); Bruns, Mitt. Inst. Bot. Hamburg **8**: 71 (1929).

PERU: Along coast of southern Peru, dept. Arequipa (Chala, Atico, Mollendo, Mejia and Islay) and dept. Moquegua (Ilo), lat. 15° 50′ to 17° 35′ S. Records from Tacna, lat. 18° S., need verification.

MATERIAL EXAMINED: Vicinity of ports of Chala and Atico, dry places, plant erect, exuding water over all the surface of the stem, corolla violet becoming blue in drying, Nov. 1863, *Raimondi 11779* (BD); Mollendo, dry sandy places at lower edge of Loma Formation, 20–100 m. alt., flowers sky blue, Oct. 1902, *Weberbauer 1481* (BD, Deles); Mollendo, June 1903, *Hill 342* (K); Mollendo, 1932, *Stafford K29* (K); Islay, 1833, *d'Orbigny* (TYPE, Paris); among rocks near the ocean at Mejia, 10 m. alt., white-flowered, Nov. 9, 1923, *Guenther and Buchtien 111* (Hamb); among rocks near ocean at Mejia, 10 m. alt., normal blue-flowered form, Nov. 6, 1923, *Guenther and Buchtien 109* (Hamb); "Tacna," erect annual with smooth stems, flower blue, Sept. 1864, *Pearce* (BM).

This species was first described and illustrated under a phrase-name by Feuillée, who collected it August 29, 1710, in a rocky place along the shore a few kilometers south of the port of Ilo. The generic name, *Tula*, was proposed by Adanson in 1763 and was founded directly and exclusively upon the description published by Feuillée in 1725. No specific name having been porposed, one was supplied by Roemer and Schultes in 1819. The resulting binomial, *Tula Adansoni*, is the oldest name for this remarkable plant. Feuillée's collection remained the only one known until 1833 when d'Orbigny rediscovered the species at Islay. In 1846 this new material was described by Remy under the name, *Sorema cordata*. A note appended to his description indicates that Remy believed that d'Orbigny's plant and that illustrated by Feuillée were conspecific. Remy, however, seems to have been unaware of Adanson's genus *Tula*. In 1852 Dunal pronounced *Tula* a synonym of Remy's species, and Adanson's genus, after nearly a hundred years as a dubious plant, questionably placed in the Rubiaceae, at last became associated with its proper family.

The fruit of this species consists of 15–20 nearly spherical nutlets. These are attached in 2–3 series to a well developed cartilaginous gynobase occupying the central half of the receptacle. The gynobase may be nearly as thick as high or may be much compressed laterally. The 3–5 nutlets borne about the summit of the gynobase are 1.5–2 mm. in diameter. The other nutlets, borne below them, are smaller being usually 1 mm. thick or less.

The species is a very distinct one. The reniform leaf-blades and the amplexicaul, stipuloid bases of the petioles are unique in the family.

18. **Nolana insularis** (Johnston), comb. nov.

Periloba insularis Johnston, Contr. Gray Herb. **95**: 32 (1931).—Type from San Gallan Island, *Murphy 3472*.

PERU: Known only from the type-station, on the fog-bathed crests of San Gallan Island, off the department of Ica, lat. 13° 55′ S.

A low spreading plant with a coarse loosely and widely branched, woody caudex. The stems are roughened with the evident corky persistent bases of old petioles. The herbage is covered with an indument of slender forked or dendritic hairs. The receptacle is occupied by a rounded gynobase bearing about 15 nutlets in 2–3 series. The nutlets about the apex of the gynobase, about 5 in number, are the largest.

19. **Nolana inflata** R. & P.

Nolana inflata Ruiz and Pavon, Fl. Peruv. **2**: 7, tab. 112a (1799); Dunal in DeCandolle, Prodr. **13**[1]: 10 (1852).—Original material collected by Tafalla in the sandy hills near Pongo and Atiquipa.

Cacabus ? inflatus (R. and P.) Miers, Ann. and Mag. Nat. Hist. ser. 2, **4**: 255 (1849) and Ill. So. Am. Pl. **2**: 51 (1857).

Nolana ventricosa Ruiz and Pavon, Fl. Peruv. **2**: 7 (1799).—Apparently a rejected tentative name.

PERU: Known only from the original localities, Pongo and Atiquipa, prov. Camaná, dept. Arequipa, and from a more recent collection from "Lurigancho, 'Camino del Inca'."

MATERIAL EXAMINED: Peru, *Pavon* as *N. inflata* (FM, BD, Boiss, Deles); Peru, *Ruiz* as *N. inflata* (K, BD); Lurigancho, "Camino del Inca," *Martinet 288* (Paris).

When originally described this species was given as based upon a description and illustration supplied by Tafalla. There are, however, collections of this plant at Chicago, Kew, Berlin and Geneva which agree sufficiently well with the original description and plate to make me feel they are parts of the original collection. All this material is labeled *Nolana inflata* and as from the herbaria of Ruiz and Pavon. A close examination of the collections and a comparison of them with the original plate suggests a number of corrections. The root is strong and almost certainly persistent. It is prolonged upwards into the thickened base of the stem which is 2.5 cm. long and ca. 1 cm. thick and is densely beset with the persistent corky bases of old leaf- and stem-bases. The several ascending or decumbent stems are slender and ascendingly branched and are very much more leafy than illustrated. The leaves are not at all regularly opposite, in fact are only very rarely and sporadically so. The calyx is not as obviously ribbed nor so shallowly toothed as shown, and the pedicels are more slender. The corollas are ca. 2 cm., certainly not more than 3 cm. long when fresh.

The Martinet collections I have cited consist of two full sheets. They agree closely with the material from the herbaria of Ruiz and Pavon. If Tafalla's original material actually came from the department of Arequipa, in southern Peru, then I suspect that the geographical data associated with Martinet's collection must be questioned. The locality given by Martinet is Lurigancho. After a study of large-scale maps and of geographical gazeteers I am forced to place his locality in the valley of the Rimac several kilometers to the northeast of Lima. The localities given by Tafalla and Martinet are, accordingly, separated by over 500 km. and 3½ degrees of latitude. In addition they belong to different floristic areas. Considering the limited distribution of most Nolanaceae, and particularly the Peruvian ones, the range of *N. inflata* as determined by the localities of Tafalla and Martinet is so unusual as to be open to suspicion.

The receptacle of *Nolana inflata* is flattened and marked off by low radiating ridges into five sections each bearing a broadly and basally affixed rounded nutlet. Between the contiguous bases of these major nutlets and attached in tiny areolas at the outer end of the ridges on the receptacle are a series of 5–8 very small angular nutlets. These latter are wedged in between the bases of the major nutlets and are 1–2 mm. long and about 1 mm. high. In the original material some of the nutlets bear on their back several stout spreading subulate appendages, nearly 0.5 mm. long. In Martinet's material, however, the nutlets bear no such appendages, though they do tend to have similarly distributed scattered conic projections that are obviously homologous.

20. **Nolana humifusa** (Gouan), comb. nov.

Atropa humifusa Gouan, Hort. Reg. Monspel. 106 (March–June, 1762).—Described from garden material.

Zwingera humifusa (Gouan) Hofer, Acta Helv. **5**: 267, tab. 1 (1763–64).

Nolana prostrata Linnaeus, Sp. Pl. ed. 2, **1**: 202 (Sept. 1762), nomen; Linnaeus fil., Decas Pl. Rar Hort. Upsal. **1**: 3, t. 2 (July–Dec. 1762); Linnaeus, Sp. Pl. ed. 2, **2**: 1678 (1763); Linnaeus, Syst. ed. 12, **2**: 149 (1767); Miller, Gard. Dict. ed 8, (1768); Linnaeus, Mant. **2**: 334 (1771); Poiret in Lamark, Encyc. **4**: 497 (1796); Willdenow, Sp. Pl. **1**: 794 (1798); Ruiz and Pavon, Fl. Peruv. **2**: 7 (1799); Dunal in DeCandolle, Prodr. **13**¹: 9 (1852); Saunders, Jour. Genetics **29**: tab. 33 fig. 7–12 (1934).—Described from garden material.

Teganium procumbens Schmidel, Icon. Pl. 67, t. 18 (1766 ?).—Described from garden material.

Atropa gymnosperma Schmidel, Icon. Pl. 67 (1766 ?).—In Synonymy.

"*Nolana prostrata* (gallinacea)" Persoon, Synop. **1**: 168 (1805).

Nolana gallinacea Persoon ex Steudel, Nom. 556 (1821).

Neudorffia peruviana Adanson ex Steudel, Nom. 553 (1821).

Belladona peruviana Adanson ex Dunal in DeCandolle, Prodr. **13**¹: 10 (1852).

Nolana parviflora Philippi, Anal. Univ. Chile **91**: 35 (1895).—Type given as from coastal southern Peru.

PERU: Confined to the coastal hills of the department of Lima, extending from Chancay, lat. 11° 30′, south to Chorrillos, lat. 12° 15′ S.

SELECTED SPECIMENS: Lomas de Chancay, Sept. 1867, leaves fleshy, flowers pale violet with darker throat, *Raimondi 10910* (BD); Amancaes, 200–400 m. alt., open rocky hill, repent herb, corolla "pallid blue-violet" at the base intricately lined with "hyacinth-blue" and "blackish," June 1925, *Pennell 14808* (G); slope of Cerro San Cristobal, among rocks, Nov. 1895, *Brenning 155* (BD); rocky slope of San Augustin, fl. blue, leaves fleshy, Nov. 1901, *Weberbauer 1* (BD, Del); Cerro San Augustin, fl. blue, Sept. 1873, *Raimondi 12411* and *12461* (BD); vicinity of Lima, fl. blue, March 1876, *Raimondi 11990* (BD); San Lorenzo Island, July 1836, *Gaudichaud* (Paris); Callao, trailing on loose sandy clay sea-side plain, fleshy, fl. blue, Sept. 1923, *Macbride 5885* (G, FM, BD); Barranco, 50–200 m., dry sandy place at lower edge of Loma Formation, fl. blue, Oct. 1902, *Weberbauer 1603* (BD); hills near Barranco, 300 m. alt., Loma Formation in clay or rocky places, stems spreading, leaves fleshy, fl. pale blue with a violet-lined throat, Sept. 1910, *Weberbauer 5701* (G, FM, BD); Chorrillos, yerba ammaná de florecitas azules, July 1873, *Raimondi 12460* (BD); Chorrillos, patches, half-decumbent on loose stony slopes of seaside hills, ca. 150 m. alt., fl. blue with dark lines within near base, Sept. 1923, *Macbride 5858* (G, FM, K, Del.).

The burst of publication regarding *Nolana* in the years following 1761 necessitates a careful determining of priority among the various names proposed for the present species. Gouan's Hortus Monspeliensis evidently has priority. Within the book, on the page giving the approval of the Royal Society, there appears the printed date, March 11, 1762. The Journal des Sçavans, pg. 443, reviewed Gouan's book in Paris in the June issue for 1762. I have been unable to determine the exact date of publication for the Decas of the Upsala Garden which was prepared by the younger Linnaeus. It bears on the title-page the date 1762. Fortunately the relative priority of the Decas and Gouan's book is adequately settled by a letter, dated July 4, 1762, addressed to Jacquin by the elder Linnaeus. In adjacent paragraphs it stated that Gouan's book has not been seen and that "Filius meus edit decurias rariorum plantarum in folio, cujus prima decuria sudat, et continet Nolanam, ..." Gouan's work was available in Paris in June and the Decas was still in preparation early in July of the same year. Through the kindness of Prof. Samuelsson inquiries regarding the dates of the Decas were made in Upsala. Dr. Arvid Hj. Uggla, secretary of the Swedish Linnaean Society replied, after a careful collation of the correspondence of Linnaeus and of the Decas with the books of the elder Linnaeus, that he suspects that the Decas was not published much before the notice in the issue of the Lärda tidningar (Stockholm) for Nov. 1st, 1762. There consequently seems good reason for accepting *Atropa humifusa* Gouan as the oldest name for the present well known Peruvian plant since it has at least one month and possibly as much as five months priority over *Nolana prostrata* L. The correct name for our plant is accordingly *Nolana humifusa* (Gouan), comb. nov.

The next possible competing name is *Zwingera* of Hofer. This was published on pg. 267 of the fifth volume of the Acta Helvetica which bears the title-page date, 1762. In the middle of the volume, on pg. 179, however, there is printed a letter bearing the date, Dec. 3, 1762! Finally in the Göttingische Anzeigen for Sept. 8, 1764, pg. 873, it is stated that the fifth volume of the Acta Helvetica "Mit vorgedrucktem Jahre 1762 aber eigentlich erst 1764 ist fertig worden." Hofer's name *Zwingera* is clearly one to two years later than the names proposed by Gouan and the younger Linnaeus.

Adanson's proposed generic name is readily eliminated also. Volume two of the Familles des Plantes bears the censor's date, Sept. 1, 1762. Otto Kuntze, Rev. Gen. 1: cxxiii (1891), has argued that the book must have, accordingly, been issued around the beginning of 1763. The only contemporary review I can find of Adanson's book is in the Parisian Mercure de France for Aug. 1763, pg. 111. The second volume of the Familles des Plantes appears to have just been issued. The review begins with the statement, "La première Parte n'a point paru; elle n'est pas entiérement imprimée." I doubt if the second volume of Adanson's work, which appeared first, could have been published before July 1763.

Though not the first species of the family known to European botanists, for *Tula* Adans. was collected by Feuillée in 1710 and described and figured by him in 1725, *Nolana humifusa* was the first of the Nolanaceae to reach European gardens and become a subject for repeated study. A rather attractive plant and, because of its fruit-structure, something of a botanical curiosity, it soon became represented in all the important botanical gardens. Under the name *Atropa humifusa* (*Atropa foliis geminatis, calycibus polycarpis caule humifuso*), Gouan gave the first published description of it before the middle of 1762, stating that the plant had been received at Montpellier as "*Atropa physalodes.*" Gouan did not know its source. In 1863–64 Hofer, of Mülhausen, provided a new description and a plate of the species and proposed the genus *Zwingera* to include *Atropa humifusa* of Gouan. In 1763 Kniphof, Bot. Orig. **10**: tab. 13 (1763), of Erfurt, also illustrated our plant under Gouan's name. Neither Hofer nor Kniphof indicate the source of their material, though we may suspect, since the plant was associated with Gouan's appelation only, that their seeds probably came from Montpellier. Schmidel, of Erlangen, in 1765–66, published a beautiful plate of our plant and a long discussion of it under the binomial *Teganium procumbens.* He cites Gouan's species as a doubtful synonym and states his material had been received as "*Atropa gymnosperma.*" His studies were made in 1762. The source of his original material is not indicated. Late in 1762 the plant was again figured and described by the younger Linnaeus. The genus and species, *Nolana prostrata,* were proposed by him upon the basis of plants grown at Upsala from seeds said to have come from Royen, of Leiden, under the phrase-name "*Belladona humifusa, flore violaceo, hispanicae.*"

In 1763 Adanson published *Neudorfia,* yet another generic name for the present plant. His material came from the Paris Garden where it was called "*Belladona Peruviana, repens, flora caerulea.*" About the same time in England, in a paper read May 1763, though not published until the following year, Ehret illustrated and described the same species under the mononomial *Walkeria* Mill., stating that it had flowered in Chelsea in 1761. He adds that "The ingenious and learned Dr. Albert Schlosser, of Amsterdam F. R. S., presented me with many curious dried specimens of plants, which he had collected in the Botanic Garden at Paris in the year 1755; amongst which was this plant, under the name of Belladona Peruviana minor. Jussieu. Hort. Reg. Paris."

The earliest record of the plant in Europe, that is to say at Paris in

1755, associates the plant with the name of Jussieu and correctly attributes it to Peru. These facts suggest the ultimate source of the garden material which became widely distributed and was described and figured in various parts of Europe in a burst of publication in 1762–63. During the middle third of the eighteenth century Bernard de Jussieu, then in charge of the Paris gardens, received many seeds from his brother Joseph, then resident in western South America. It is well known that many plants were raised at Paris from Bolivian, Ecuadorian and Peruvian seeds received from Joseph de Jussieu. The familiar garden Heliotrope is perhaps the most famous and successful result of his seed collecting. It seems not at all improbable, therefore, that the *Nolana* also appeared at Paris through his efforts and from that center, about 1760 was eventually sent to other European gardens.

Gouan, Hofer, Kniphof and Schmidel, among the authors before 1800, offered no suggestions as to the native home of *Nolana*. The younger Linnaeus, citing Royen's polynomial which attributed the plant to Spain, remarked that "Patria hujus omnino me fugit, nisi sit. Hispania." It is very interesting to note, however, that a year earlier, the elder Linnaeus in a letter (dated Aug. 25, 1761) to Boissier de Sauvages, the friend and predecessor of Gouan at Montpellier, questions the source of the plant as follows, "Annon vidisti *Belladonnam* (*atropam*) *humifusam*, Hispanicam? Non credo quod sit originis Hispanicae; an Peruviana?" Adanson at Paris attributes the species to Peru. Ehret in London entitled his paper "A New Peruvian Plant" and cites a garden-name from Paris indicating the same origin. Nevertheless five years later, in 1768, Miller in his Dictionary gives the plant as from Egypt and states he had received seeds of it from Forskål. In the second Mantissa, in 1771, Linnaeus gives Peru as the unquestioned source of the *Nolana*, and in 1799 the matter was finally settled definitely by Ruiz and Pavon who described plants they had personally collected near Lima, Peru. It is most fortunate that our plant possesses a prominent and distinctive character in the plicate sinus of the calyx. This development permits the exact identification of garden material illustrated before 1800 and clearly associates this material with the common plant of the seaward slopes in the vicinity of Lima. The original seeds of *Nolana* came from within a hundred kilometers of Lima and probably from the hills in its immediate environs. They were collected, I believe, by Joseph de Jussieu.

21. **Nolana coronata** R. & P.

Nolana coronata Ruiz and Pavon, Fl. Peruv. **2**: 6, tab. 112b (1799); Dunal in DeCandolle, Prodr. **13**[1]: 10 (1852).—Original material from near Pongo and Atiquipa, collected by Tafalla.

PERU: Coast of the department of Arequipa.

SPECIMENS EXAMINED: Peru, *Pavon* as *N. coronata* (Boiss, Deles); Peru, *Ruiz* as *N. coronata* (K, BD); Atiquipa, lat. 15° 50′ S., flower clear blue-violet with dark center, Oct. 1863, *Raimondi 10857* (BD).

There is apparently authentic material of this species, from the herbaria of Ruiz and Pavon, at Chicago, Kew, Berlin and Geneva. Although a poor specimen, Raimondi's collection is evidently conspecific. A study of the old material shows that the underground parts of *N. coronata* is a short-lived tap-root and that the base of the plant may become somewhat woody and persistent. The stems are ascending and glabrous. The specimens do not have the hairy stems illustrated and the calyx is not so patently ribbed. I know the fruiting parts of this species only from the plate accompanying the original description. The species seems to be the closest relative of *N. humifusa.*

22. **Nolana plicata** Johnston

Nolana plicata Johnston, Contr. Gray Herb. **85**: 174 (1929).—Type from near Atiquipa, *Weberbauer 7190.*

PERU: Known only from the type collection.

SPECIMEN EXAMINED: Atiquipa, dept. Arequipa, lat. 15° 50′ S., in the Loma Formation, 270 m. alt., spreading and suffrutescent, corolla bluish pink with the throat violet, Nov. 28, 1915, *Weberbauer 7190* (FM, TYPE; BD).

The calyx is conspicuously plicate having prominent folds through each sinus. The calyx-lobes are sharply triangular and not half the total length of the calyx. The latter is lance-ovate in outline being broadest just above the rounded base and then gradually contracted towards the apex formed by the connivent lobes. The species is probably most closely related to *N. coronata* which is a glabrate plant with broader leaf-blades more abruptly contracted into the petiole.

23. **Nolana Guentheri** sp. nov.

Herba laxe decumbens; radice ignota; caulibus pluribus 2–5 dm. longis sparse ramosis 3–5 mm. crassis fistulosis dense glanduliferis plus minusve villosis mox glabrescentibus, 2–12 cm. longis, ascendentibus, internodiis 3–7 cm. longis; foliis compressis; lamina elliptica vel obovata, 15–25 mm. lata, 2–3 cm. longa, infra medium basim versus in petiolum 1–1.5 cm. longum et 1.5–2 mm. latum plus minusve villosum attenuata evidenter medio-costata inconspicue sparseque nervata apice rotundata margine plus minusve villosa ceterum subglabra; calyce ad anthesin 10–13 mm. longo stipitato-glanduloso villoso, tubo 3–4 mm. profundo ca. 5 mm. crasso, lobis erectis cuneato-lanceolatis 1.5–2 mm. latis apice acutis; pedicellis 1–5 mm. longis; calycibus fructiferis subhyalinis fructu disruptis, lobis incurvatis, pedicellis 5–25 mm. longis recurvatis; corolla coerulea infundibuliformi 2.5–3 cm. longa et lata, lobis ascendentibus ovatis apice rotundis; nuculis 5 equalibus angulatis uniseriatis ca. 4 mm. longis, dorse convexis, margine angulatis, ventre cicatrix ca. 3 mm. diametro convexis ornatis; receptaculo ca. 6 mm. diametro 3 mm. alto in fossas 5 conspicuas concavas profunde excavato.

PERU: Cáchendo east of Mollendo, dept. Arequipa, 1000 m. alt., Oct. 15, 1923, *Guenther and Buchtien 113* (TYPE, Hamburg).

A well marked species resembling *N. humifusa* in gross habit but different in being slightly coarser throughout with evidently hairy herbage and a very different calyx. The type was placed under *N. prostrata* by Bruns, Mitt. Inst. Bot. Hamburg **8**: 72 (1929).

24. **Nolana polymorpha** Gaud.

Nolana polymorpha Gaudichaud, Bot. Voyage Bonite, Atlas tab. 101 (1851–52).

I know this species only from Gaudichaud's plate. No material possibly referable to this remarkable plant has been seen in any of the herbaria visited. Possibly the type may be preserved in the Webb collections at Florence. It may have been collected at Cobija, Chile. The stems are shown as quite shrubby and as bearing numerous tight buds on the old wood. The nutlets are shown as 5 in number, broadly ellipsoid and strongly keeled. Their attachment is small and obliquely basal. The corolla is large with a broad open throat. The calyx is deeply bifid on two sides, with the divergent lobes weakly 2–3 dentate at their apices. It is, hence, distinctly bilabiate. The root is shown as very long, strong and woody. I can suggest no close relative for the plant as illustrated by Gaudichaud.

25. **Nolana thinophila** sp. nov.

Planta gracilis procumbens laxe ramosa 2–5 mm. diametro succulenta inconspicue glandulosa plus minusve glutinosa glaberrima; caulibus suffruticosis 1.5–3 mm. crassis internodiis 1–5 cm. longis; foliis compressis spathulatis 1–3 cm. longis 1.5–3 mm. latis medium versus latioribus basim versus gradatim attenuatis apice rotundis vel obtusis; pedicellis gracilibus 6–15 mm. longis ascendentibus, fructiferis recurvatis; corolla coerulea 15–20 mm. longa ca. 10 mm. diametro, lobis ovatis ascendentibus, tubo ca. 8 mm. longo 1–1.5 mm. crasso quam calyce evidenter longiore intus sparse villosulo; filamentis linearibus 4–5 mm. longis inaequalibus; calycibus 6–7 mm. longis bifidis haud dentatis, tubo cylindrico 2–3 mm. crasso maturitate nuculis distento demum disrupto 4–5 mm. crasso; nuculis nigris plus minusve inaequalibus saepe 5 elongatis 3–5 mm. longis 2–2.5 mm. crassis dorso rotundis ventre areola elliptica ca. 3 mm. longa ornatis; receptaculo 10–15-dentato gynobasi humili ca. 2 mm. lata ca. 0.5 mm. alta ornato.

PERU: Sea-shore in the vicinity of Mollendo, dept. Arequipa, lat. 17° S.

SPECIMENS EXAMINED: Sandy sea-beach, Mollendo, succulent herb forming loose mats 2–5 m. broad, corolla "pleroma-violet," May 31, 1925, *Pennell 14280* (TYPE, Gray Herb.); seashore at Mollendo, *D. Safford K55* (K); abundant on seashore at Mejia, flowers blue, July 22, 1923, *Guenther and Buchtien 121* (Hamb).

A very distinct species notable in particular for its cleft but quite unlobed or untoothed calyx, its glabrous but glandular glutinous herbage, and its 5 elongate erect nutlets. The black nutlets are rounded on the back. The face is occupied by a large scar. They are seated on a very low and broad gynobase and are joined to one another ventrally. The collection from Mejia has been reported as *Dolia rupicola* by Bruns, Mitt. Inst. Bot. Hamburg. **8**: 71 (1929).

26. **Nolana aplocaryoides** (Gaud.), comb. nov.

Leloutrea aplocaryoides Gaudichaud, Bot. Voyage Bonite, Atlas tab. 110 (1851–52).—Type collected at Cobija by Gaudichaud.

Bargemontia aplocaryoides (Gaud.) Johnston, Contr. Gray Herb. **85**: 110 and 157 (1929).

Alona pusilla Philippi, Fl. Atac. 45 (1860) and Viage Des. Atac. 10, 16, 219 (1860); Reiche, Anal. Univ. Chile **125**: 499 (1910) and Fl. Chile **5**: 427 (1910).—Original material collected by Philippi at Caldera and near Cachinal de la Costa.

CHILE: Coastal plain of the provinces of Antofagasta and Atacama, from Cobija south to Caldera, lat. 22° 30′ to lat. 27° 15′ S.

SPECIMENS EXAMINED: Caldera, Oct. 1924, *Werdermann 1655* (G, BD); hills back of Barquito, erect clammy succulent herb on gravelly alluvial fan, corolla lavender, Oct. 1925, *Johnston 4814* (G); Taltal, herb, fleshy, very glandular and viscid, corolla pale bluish, 100 m. alt., Oct. 1925, *Werdermann 774* (G, BD); Punta Buitre, erect annual in sand, flowers lavender, Dec. 1933, *Johnston 5243* (G); Antofagasta, dry gravelly plain, plant erect, clammy, corolla dilute bluish, Oct. 1925, *Johnston 3639* (G); Cobija, *Gaudichaud 1* (Paris).

A very well marked species notable in particular for its excessively clammy slimy indument and for the reduction in number of nutlets. A study of the immature fruit shows that five rudimentary nutlets are present. Of this number two or rarely even more are regularly aborted.

27. **Nolana Pearcei** sp. nov.

Herba annua erecta 2–3 dm. alta supra medium sparse ascendenter ramosa, partibus junioribus sparse inconspicueque glandulosis et sparse villosis; ramulis ultra medium conspicue foliatis et breviter ramulosis; foliis apicem versus ramorum congestis, laminis compressis ellipticis vel anguste lanceolatis 1–2 cm. longis 3–6 mm. latis infra medium in petiolum gracilem 6–10 mm. longum gradatim vel abrupte attenuatis margine vix revolutis apice acutis; pedicellis ca. 1 mm. longis; calycibus ad anthesin 6–8 mm. longis, tubo cupulari 2–3 mm. diametro 1.5–2.5 mm. profundo, lobis angustis valde inaequalibus linearibus vel cuneatis; calycibus fructiferis ignotis; corolla coerulea infundibuliformi 2–2.5 cm. longa extus sparse puberula, tubo lobis calycis subaequali intus breviter piloso ca. 1.3 mm. crasso, lobis rotundis ascendentibus, limbo 10–15 mm. diametro; staminibus linearibus inaequalibus 6 et 8 mm. longis glabris; fructibus ignotis.

Peru: Tacna, erect tree-like annual, flowers blue, Sept. 1864, *Pearce* (TYPE, Kew; isotype Brit. Mus.).

The type consists of only the upper part of the plant and is in the flowering condition only. The material at the British Museum shows the root, but is a poorer specimen. The species is obviously a very distinct one, probably having its closest relations in *N. aplocaryoides*.

28. **Nolana Weberbaueri** sp. nov.

Herba annua erecta 1–2 dm. alta pilis numerosis inconspicuis erectis plerumque glanduliferis vestita; caulibus fistulosis 2–3 mm. crassis pallidis infra medium plus minusve simplicibus supra laxe dichotomeque ramosis, internodiis 1–3 cm. longis; foliis aliquantum succulentis pallidis, lamina ovata vel deltoideo-ovata 7–15 mm. longa 4–10 mm. lata apice obtusa basi rotunda vel obtusa in petiolum gracilem 5–20 cm. longum abrupte contracta evidenter costata; pedicellis ad anthesin gracillimis erectis ca. 4 mm. longis, fructiferis duplo vel triplo longioribus imam ad basim abrupte deflexis; calycibus ad anthesin 4–5 mm. longis profunde lobatis, tubo ca. 2 mm. diametro cupulato ad 1 mm. profundo, lobis inaequalibus linearibus vel cuneatis; corolla rubro-violacea infundibuliformi 15–18 mm. longa extus minute sparseque puberulenta, tubo 2–3 mm. longo intus minute villuloso ca. 1 mm. crasso quam calyce breviore, limbo ca. 12 mm. diametro, lobis rotundis brevibus ascendentibus; filamentis inaequalibus linearibus glabris 4–5 mm. longis; nuculis 4–6, conspicue tuberculato-rugosis irregulariter depresseque globosis 2–3 mm. diametro nigris.

PERU: Western Andean slopes east of the port of Pisco, between Huauyanga and Pampano, district Huancáno, dept. Ica, 1000–1200 m. alt., steep rocky places, annual herb with somewhat fleshy leaves, flowers "rot-lila," May 1910, *Weberbauer 5385* (TYPE, Gray Herb.; FM, BD).

The affinities of this plant are obviously with *N. laxa*, another species of the western cordilleran slopes of central Peru. The present species comes from about lat. 13° 45′ S. and nearly 100 km. inland. Its only known locality is southeasterly from Lima. That of its relative, *N. laxa*, is roughly northeasterly from the Capital. They are distinctly plants of the interior.

29. **Nolana laxa** (Miers), comb. nov.

Dolia laxa Miers, Hooker London Jour. Bot. **4**: 504 (1845) and Ill. So. Am. Pl. **1**: 57 (1850); Dunal in DeCandolle, Prodr. **13**^{1}: 16 (1852).—Type given as from Canta.

PERU: known only from Canta, dept. Lima, lat. 11° 25′ S.

MATERIAL EXAMINED: Canta, *ex herb Ruiz and Pavon, Lima* (Kew, TYPE).

The type and only known collection of this plant consists of three small branches. There is fruit but no vestiges of the corolla. The very slender habit of the plant, the kind of pubescence and glandularity, the leaf-texture, the shape of the calyx, the size and direction of the pedicels, the distinctly roughened nutlets, etc., all indicate a very close affinity with *N. Weberbaueri.* All this makes me believe that future collections will prove that *N. laxa* is also a slender erect annual herb. So evident is the relation between these two species that I should not be surprised if intergrades are discovered. The present species comes from the cordilleran slopes about 70 km. inland. At Canta it sets the northern limit of the family on the continent. The altitude of that town is given on maps as 2942 meters.

30. **Nolana gracillima** (Johnston), comb. nov.

Bargemontia gracillima Johnston, Contr. Gray Herb. **85**: 176 (1929).—Type from hills near Moquegua, *Weberbauer 7457.*

PERU: Departments of Moquegua and Tacna. CHILE: Province of Arica. A species of the interior; growing above 1500 m. alt., 20–60 km. from the coast at the base of the cordilleras east of the coastal deserts; lat. 17° 12′ south to lat. 19° S.

SPECIMENS EXAMINED: Hills southeast of Moquegua, dept. Moquegua, lat. 17° 12′ S., long. 70° 50′ W., with other desert annuals, alt. 1500–1600 m., flowers violet, leaves fleshy, March 1925, *Weberbauer 7457* (FM, TYPE; G, K, Deles); Tacna, dept. Tacna, in sandy places, erect annual 15–30 mm. tall, flowers blue, Sept. 1864, *Pearce* (K); Putaralla, valley of the Rio Camarones, dept. Arica, lat. 18° 58′ S, long. 69° 40′ W., 2000 m. alt., April 14, 1927, *Troll 3300* (BD).

The type of *N. gracillima* was collected in the same region as that of *N. platyphylla.* Among the specimens on the isotypic sheet of this species at the Gray Herbarium there is one plant that combines, curiously, a number of the quite diverse traits of *N. gracillima* and *N. platyphylla.* This plant is, I believe, a hybrid. The fruit of *N. gracillima* consists of 5 subequal globose nutlets that are affixed to a flattened receptacle. The plant is distinctly annual and quite herbaceous.

31. **Nolana platyphylla** (Johnston), comb. nov.

Bargemontia platyphylla Johnston, Contr. Gray Herb. **85**: 175 (1929).—Type from near Moquegua, *Weberbauer 7455.*

PERU: Known only from the type locality; about 50 km. from the coast east of the coastal desert at the base of the cordilleras in the department of Moquegua.

SPECIMEN EXAMINED: Hills southeast of Moquegua, lat. 17° 12′ S., long. 70° 50′ W., 1500–1600 m. alt., with other desert annuals, flowers sky-blue, leaves fleshy, March 1925, *Weberbauer 7455* (FM, TYPE; G, K, DB, Deles).

Related to *N. gracillima* but except for an evident hybrid plant, abundantly distinct from that species. It is coarser throughout and is much less freely branched in habit. The pedicels are stouter and the calyx is larger and coarser than in any of the Peruvian annuals of this immediate relationship. The 5–10 nutlets are erect, obovoid and basally affixed. They are uniseriate and subequal and are affixed to a low convex gynobase. The receptacle is about 10-toothed.

32. **Nolana flaccida** (Phil.), comb. nov.

Alona ? flaccida Philippi, Anal. Univ. Chile **91**: 39 (1895); Reiche, Anal. Univ. Chile **125**: 501 (1910) and Fl. Chile **5**: 429 (1910).—Type collected in Valle del Salado by San Roman.

Bargemontia flaccida (Phil.) Johnston, Contr. Gray Herb. 85: 109 (1929).

Alona patula Philippi ex Wettstein in Engler and Prantl, Nat. Pflanzenfam. iv. **3b**: 3 (1891), nomen; Philippi, Anal. Univ. Chile **91**: 39 (1895).—Type-specimens collected by San Roman in Valle de Juncal and in Quebrada de Chaco.

CHILE: Gravelly stream-ways in northernmost Atacama (Valle de Salado, Caleta de Pan de Azucar, Carrizalillo and Juncal), lat. 26° 25′ to 25° 50′ S.; also reported by Philippi from El Chaco, lat. 25° 27′ S., in southernmost Antofagasta. The plant occurs from the coast to over a 125 km. inland and from sea-level to 2000–3000 meters in altitude.

This species along with *N. mollis* forms a small natural group quickly separable from the other shrubby species by having a coarse, cylindrical, short-toothed calyx and comparatively large corollas. The two species tend to develop more nutlets (5–10) than is common among the shrubby members of the genus. *Nolana flaccida* is a loosely and very widely branched, prostrate, pale green, practically glabrous shrub 1.5–3 dm. high and 10–20 dm. broad.

33. **Nolana mollis** (Phil.), comb. nov.

Alona mollis Philippi, Fl. Atac. 44 and Viage Des. Atac. 16, 24, 38, 218 (1860); Reiche, Anal. Univ. Chile **125**: 499 (1910) and Fl. Chile **5**: 427 (1910).—Type collected at Cachinal de la Costa by Philippi.

Bargemontia mollis (Phil.) Johnston, Contr. Gray Herb. **85**: 109 (1929).

Dolia macrocalyx Philippi, Anal. Univ. Chile **91**: 45 (1895); Reiche, Anal. Univ. Chile **125**: 502 (1910) and Fl. Chile **5**: 430 (1910).—Type collected near Taltal by Borchers.

CHILE: Gravelly slopes and stream-ways near coast, from Chañaral to Taltal, lat. 26° 30′ north to 25° 15′ S., in adjacent portions of the provinces of Atacama and Antofagasta.

A globose or decumbent shrub with its rather succulent herbage covered with a slimy indument of long simple hairs. Known only from within a few kilometers of the coast, the species has been collected near Barquito, Caleta de Pan de Azucar, Cachinal de la Costa, Aguada de Cachina, and Taltal. Material from the port of Antofagasta reported by Herzog as *D. macrocalyx* proves to represent *Nolana peruviana*, cf. Johnston, Revista Chilena **34**: 232 (1930).

34. **Nolana tarapacana** (Phil.), comb. nov.

Dolia tarapacana Philippi, Cat. Pl. Itin. Tarapaca 68 (1891); Reiche, Anal. Univ. Chile **125**: 505 (1910) and Fl. Chile **5**: 433 (1910).—Type from the Médanos de Pica.

Bargemontia tarapacana (Phil.) Johnston, Contr. Gray Herb. **85**: 110 (1929).

CHILE: Known only from the sands near Pica, prov. Tarapacá, at the base of the cordillera about 100 km. inland, lat. 20° 30′ S. and long. 69° 20′ W.

Specimen examined: Quebrada de Quisma near Pica, 1400 m. alt., flowers small, deep blue, Sept. 1925, *Werdermann 741* (G, BD).

I have judged this species upon the basis of the collection above cited. The plant seems particularly notable by having its small tubular corollas only shortly surpassing the slender elongate calyx-lobes, and in having the calyx-tube well developed, tightly and completely investing the fruit, and finally irregularly disrupted by it at maturity. The receptacle is very unequally and deeply 3–8-lobed and bears a thin erect transverse plate bearing the style. The 3–7 nutlets are attached to the receptacle near their basal end. Were the receptacle explanate the elongate suprabasally attached nutlets would be spreading. Perhaps because of the crowding of the growing structures within the tight calyx-tube, the receptacle is distorted with the margins and lobes irregularly upturned and the nutlets are forced into an erect position. The nutlets are very unequal and through crowding somewhat angulate.

35. **Nolana linearifolia** Phil.

Nolana linearifolia Philippi, Anal. Univ. Chile **91**: 28 (1895); Reiche, Anal. Univ. Chile **125**: 484 (1910) and Fl. Chile **5**: 412 (1910).—Type collected in the Sierra Esmeralda by San Roman.

Bargemontia linearifolia (Phil.) Johnston, Contr. Gray Herb. **85**: 109 and 156 (1929).

Nolana decemloba Herzog, Mededeel. Rijks Herb. **29**: 20 (1916).—Type from the coastal hills near Antofagasta, *Herzog 2319*.

Chile: Growing in very arid gravelly places in the province of Antofagasta. Known from three localities; inland in the Sierra Esmeralda (lat. 25° 50′ S.), crest of the coastal hills above the fog belt at Aguada Panulcito (lat. 24° 50′ S.), and in the dry quebradas in the coastal hills about Antofagasta (lat. 23° 40′ S.).

The delicate, bright blue, tubular corollas of this species have the lobes so strongly and deeply notched as to appear 10-lobed. In habit the plant is trailing. Some plants flower very quickly and appear to be herbaceous annuals. There is good indication, however, that normally these plants persist for several years. The fruit consists of 3–6 spherical or ovoid, black nutlets, ca. 2 mm. in diameter. These are basally affixed to a cartilaginous receptacle. Hence, though the species is aberrant in corolla, the fruit agrees closely with that prevailing among the shrubby members of its genus.

36. **Nolana salsoloides** (Lindl.), comb. nov.

Dolia salsoloides Lindley, Bot. Reg. **30**: sub tab. 46 (1844); Miers, Hooker London Jour. Bot. **4**: 503 (1845) and Ill. So. Am. Pl. **1**: 56

(1850); Gay, Fl. Chile **5**: 109 (1849); Dunal in DeCandolle, Prodr. **13**[1]: 15 (1852).—Type collected by Macrae in "Chile," probably north of Coquimbo.

Bargemontia salsoloides (Lindl.) Johnston, Contr. Gray Herb. **85**: 111 (1929), as to name only.

? *Alona micrantha* Philippi, Fl. Atac. 44 (1860) and Viage Des. Atac. 16, 218 (1860).—Type collected by Philippi near Cachinal de la Costa.

? *Dolia micrantha* (Phil.) Reiche, Anal. Univ. Chile **125**: 503 (1910) and Fl. Chile **5**: 431 (1910).

? *Bargemontia micrantha* (Phil.) Johnston, Contr. Gray Herb. **85**: 108 (1929).

Alona xerophila Philippi, Fl. Atac. 44 (1860) and Viage Des. Atac. 17, 218 (1860); Reiche, Anal. Univ. Chile **125**: 500 (1910) and Fl. Chile **5**: 428 (1910).—Type collected by Philippi near Cachiyuyal, ca. 600 m. alt., lat. 25° 46′ S.

Alona rigida Philippi, Anal. Univ. Chile **91**: 38 (1895).—Type collected by San Roman in the Sierra Esmeralda.

Osteocarpus spathulatus Philippi, Anal. Univ. Chile **91**: 41 (1895).—Type collected by Geisse on the Morro de Caldera.

Dolia puberula Philippi, Anal. Univ. Chile **91**: 43 (1895).—Type-material from Copiapó and Chañarcillo.

Dolia clavata var. *puberula* (Phil.) Reiche, Anal. Univ. Chile **125**: 506 (1910) and Fl. Chile **5**: 434 (1910).

? *Dolia hirsutula* Philippi, Anal. Univ. Chile **91**: 46 (1895).—Type collected by Larrañaga at Breas.

CHILE: Ranging from the Taltal Valley, in the prov. Antofagasta, southward into the northwestern parts of the prov. Coquimbo; growing along the coast and in the dry interior; lat. 25° 20′ south towards lat. 30° S. Reported as far south as "Coquimbo."

As here taken *N. salsoloides* is a variable species and one which future collecting and further study may prove to consist of several varieties or close species worthy of recognition. It is closely related to *N. divaricata* (= *Dolia clavata* Miers!), differing in having hairy younger foliage and branchlets, and narrower and more elongate leaves. The plant is a shrub, 5–10 dm. tall and has blue corollas.

The type of *N. salsoloides* was collected by Macrae during the ten days that the *Blonde* lay at anchor in Coquimbo Bay early in December 1825. The type is not representative of the common form of the species as here defined. I have seen no other material like it from the province of Coquimbo. A party from the *Blonde*, however, did visit Arqueros, a mining district northeast of Coquimbo. It seems most probable, therefore, that the type of *N. salsoloides* may have come from that locality, especially since many plants of Arqueros do have their closest affinities in western Atacama, the very region in which some forms suggesting the type of *N. salsoloides* have been found. Since the *Blonde* put in at none of the ports between Coquimbo and Callao it is obvious that the application of the name *N. salsoloides* by Gaudichaud, Philippi, Reiche and Johnston, to an endemic plant of the arid northern coast of Chile must be erroneous. This northern plant, in fact, is very distinct from *N. salsoloides* and is described in this paper as *N. ramosissima.* Macrae's collection of *N. salsoloides* is represented by the type in the Lindley collections at Cambridge University, and by an isotypic duplicate in the Bentham collections at Kew. A study of these collections shows that the young branchlets bear numerous short spreading more or less glandular hairs. The slender, spathulate leaves bear scattered glandular hairs but tend to become quite glabrous in age. The original collections have no curly hairs and do not have the axillary flocculae that are so characteristic of most plants I am treating with them. They are, however, remarkably like material from Copiapó that has been determined as *D. puberula* by Philippi. The ultimate disposition of this rare typical form of *N. salsoloides* must await further collecting and study.

One of the common forms of this broadly drawn species is that represented by material from about Caldera. This has the stems, and frequently the leaves, bearing slender somewhat curling hairs. The type of *O. spathulatus* is an extreme form of it.

North of Caldera the plants tend to have the pubescence not spreading, but rather more or less appressed and interlaced and hence somewhat arachnose-wooly. *Alona xerophila* and *A. rigida* have this type of indument. The types of these two species, coming from the markedly desert interior, are more stiff and woody, but otherwise are much like plants from the more favorable situations nearer the coast (e. g. *Werdermann 834* from near Taltal). I have seen no authentic material of *D. micrantha* and *D. hirsutula.*

37. **Nolana divaricata** (Lindl.), comb. nov.

Aplocarya divaricata Lindley, Bot. Reg. **30:** sub. tab. 46 (1844); Gay, Fl. Chile **5:** 107 (1849); Dunal in DeCandolle, Prodr. **13**^{1}: 18 (1852); Philippi, Anal. Univ. Chile **18:** 57 (1861); Philippi, Linnaea **33:** 208 (1864).—Type from Coquimbo, *Cuming 862.*

Dolia divaricata (Lindl.) Hooker and Arnott ex Wettstein in Engler and Prantl, Nat. Pflanzenfam. iv. **3b:** 4 (1891); Reiche, Anal. Univ. Chile **125:** 506 (1910) and Fl. Chile **5:** 434 (1910).

Bargemontia divaricata (Lindl.) Johnston, Contr. Gray Herb. **85:** 108 (1929).

Dolia clavata Miers, Hooker London Jour. Bot. **4:** 503 (1845) and

Ill. So. Am. Pl. **1:** 56 (1850); Gay, Fl. Chile **5:** 109 (1849); Dunal in DeCandolle, Prodr. **13**[1]: 15 (1852); Reiche, Anal. Univ. Chile **125:** 506 (1910) and Fl. Chile **5:** 434 (1910).—Type: *Bridges 1324,* originally given as from "Concepcion," but actually from near the coast at Coquimbo.

Bargemontia clavata (Miers) Johnston, Contr. Gray Herb. **85:** 106 (1929).

? Alona sphaerophylla Philippi, Fl. Atac. 44 (1860) and Viage Des. Atac. 12, 218 (1860); Reiche, Anal. Univ. Chile **125:** 499 (1910) and Fl. Chile **5:** 427 (1910).—Type collected by Philippi in Valle de las Animas, east of Chañaral.

? Bargemontia sphaerophylla (Phil.) Johnston, Contr. Gray Herb. **85:** 107 (1929).

Osteocarpus clavatus Philippi, Anal. Univ. Chile **91:** 41 (1895).—Type collected on the Morro de Caldera by Geisse.

CHILE: Near the coast from southwestern parts of the prov. of Antofagasta (Aguada de Cachina), southward to Ovalle in the province of Coquimbo, lat. 26° south to lat. 31° S.

In its common extreme form this species is characterized by its broadly spathulate or clavate, quite glabrous leaves. These are gradually expanded and cuneate to well above the middle, where they are abruptly enlarged into a globose or ovoid, thick, blade-like upper third. The plant forms a dense succulent globose bush 1–2.5 m. tall and seems to be confined to the hills near the sea.

The type of *N. divaricata* is said to have come from Coquimbo, but as with others of Cuming's collections so labeled, it may have been obtained at some of the small Chilean ports further north. The type, unfortunately, is not the common form of the species. The leaves are not so broadly and abruptly expanded as usual, and the youngest branchlets and leaves bear some scattered short inconspicuous hairs. It is, in fact, more or less transitional between the common forms of what I am calling *N. divaricata* and those I have treated under the name *N. salsoloides.* In the past the name *D. divaricata* has been associated with the latter concept. The type, however, has more of the characters of the plants I am now associating with it.

The type of *Dolia clavata* is the common and characteristic form of the present species. Although originally given as from Concepcion it came, in fact, from the coast near Coquimbo. The collector noted it to be a shrub 3–9 dm. tall and as having blue flowers. The data on the type-locality previously given by me, Contr. Gray Herb. **85:** 107 (1929), is quite incorrect! *Osteocarpus clavatus,* from the headlands near Caldera, seems to be quite similar to *D. clavata. Alona sphaerophylla* must be an extreme xerophytic form with crowded reduced leaves.

38. **Nolana glauca** (Johnston), comb. nov.

Bargemontia glauca Johnston, Contr. Gray Herb. **85:** 105 (1929).—Type collected in the hills back of Barquito, *Johnston 4770.*

CHILE: Known only from the type-material collected in the coastal hills of northwestern Atacama, lat. 26° 22′ S.

A sprawling quite glabrous shrub with distinctly glaucous herbage and white corollas. A very distinct species with closest relations, probably, in *N. divaricata* or *N. peruviana.*

39. **Nolana peruviana** (Gaud.), comb. nov.

Bargemontia peruviana Gaudichaud, Bot. Voyage Bonite, Atlas tab. 8 (1841); Walpers, Repert. **6:** 551 (1847); Dunal in DeCandolle, Prodr. **13**[1]: 18 (1852); Johnston, Contr. Gray Herb. **85:** 159 (1929) and Revista Chilena **34:** 232 (1930).—Type collected at Cobija by Gaudichaud.

CHILE: Known only from the coastal hills of the province of Antofagasta (Tocopilla, Cobija and Antofagasta), lat. 22° to 23° 40′ S.

SPECIMENS EXAMINED: Coastal hills near Tocopilla, Aug. 1925, *Berninger 440* (BD); Tocopilla, 1930, *Jaffuel 1043* (G); Cobija, *Gaudichaud* (BD, Deles); rocks about Cobija, half-prostrate bush, 3–6 dm. tall, corolla yellowish, Aug. 1864, *Pearce* (K); Antofagasta, 1914, *Rose 19420* (NY, US); Antofagasta, 1930, *Jaffuel 1118* (G); open rocky canyon, Antofagasta, forming wide clumps, 1925, *Pennell 13017* (G, NY, K); small shrub on rocky desert near Antofagasta, flowers pale yellowish, *Herzog 2455* (BD, Leiden).

Suggesting the common forms of *N. divaricata* in the shape of leaf, but evidently more related to *N. crassulifolia* and its allies. The species is very well marked and has been admirably illustrated by Gaudichaud. Herzog, Meded. Rijks Herb. **29:** 22 (1916), has reported his collection under the incorrect name, "*Dolia macrocarpa.*"

40. **Nolana albescens** (Phil.), comb. nov.

Dolia albescens [Philippi] Wettstein in Engler and Prantl, Nat. Pflanzenfam. iv. **3b:** 4 (1891), nomen; Philippi, Anal. Univ. Chile **91:** 44 (1895); Reiche, Anal. Univ. Chile **125:** 504 (1910) and Fl. Chile **5:** 432 (1910).—Type collected at Monte Amargo.

Bargemontia albescens (Phil.) Johnston, Contr. Gray Herb. **85:** 108 (1929).

Dolia canescens Philippi, Anal. Univ. Chile **91:** 46 (1895).—Type collected at Galena by Geisse.

CHILE: Dry hills about the Copiapó Valley and just southward to the vicinity of Chañarcillo, prov. Atacama, lat. 27° 20′ south to 27° 50′ S.

Closely related to *N. incana* of the coastal area north and south of Taltal, but apparently a more bushy and erect plants and evidently more of an interior than a coastal species. The ranges of *N. albescens* and *N. incana* are separated by a geographical hiatus of over a hundred kilometers. *Nolana albescens* is usually a bush about a meter high and has white corollas. As I have previously remarked, l. c., it gives some evidence of being a myrmecophyte.

41. **Nolana Werdermannii** sp. nov.

Frutex 1–1.5 m. altus griseus dense minuteque stellato-tomentosus inconspicue glandulosus; ramis gracilibus erectis vel ascendentibus teretibus in partibus vetustioribus plus minusve glabrescentibus; internodiis 5–10 cm. longis quam foliis brevioribus; foliis alternis numerosis lineari-spathulatis vel linearibus carnosulis plus minusve compressis ascendentibus 1.5–2.5 cm. longis 1–2.5 mm. latis apicem versus latioribus deinde basim versus gradatim attenuatis, apice obtusis, margine anguste inconspicueque revolutis; floribus in axillis foliorum superiorum solitariis; pedicellis gracilibus 3–6 mm. longis ascendentibus quam foliis brevioribus, fructiferis reflexis paullo robustioribus; calyce ad anthesin 6–7 mm. longo, tubo cupulato 2–2.5 mm. longo et crasso, lobis 5 erectis cuneatis inaequalibus 4–5 mm. longis imam ad basim 0.8–1 mm. latis apice acutis fauces vel sinus corollae attingentibus; tubo calycis fructiferi subexplanato, lobis erectis vel supra nuculas subfornicatis; corolla 7–8 mm. longa alba extus puberulente, tubo 5–6 mm. longo quam calyce breviore cylindrico intus basim versus dense pubescente, faucibus vix differentiatis, lobis ascendentibus ovatis 1.5 mm. latis ad 2 mm. longis apice rotundis; staminibus inaequalibus 2.5–3.5 mm. longis, 1 mm. supra basim incrassatis et dense pubescentibus; antheris ellipsoideis; nuculis 5 nigrescentibus uniseriatis angulato-ovoideis 2.5–3 mm. longis rugulosis oblique basi affixis.

Chile: Below Alto de Carmen, 80 km. from the coast in the valley east of Vallenar, prov. Atacama, lat. 28° 46′ S., long. 70° 29′ W., 800 m. alt., shrub becoming 15 dm. tall, gray with small white flowers, leaves somewhat fleshy, Nov. 1923, *Werdermann 169* (Gray Herb., type; FM, BD, K).

A member of the group of *N. crassulifolia* characterized by its small corollas, slender leaves, and well developed pedicels. Its nearest relative is probably *N. albescens* which grows to the north of it, also in the region back from the coast.

42. **Nolana crassulifolia** Poeppig

Nolana crassulifolia Poeppig in Froriep, Notizen **23**: 276 (1829); Walpers, Repert. **6**: 549 (1847).—Type collected by Poeppig (no. 67) on the coast near Concon.

Nolana grossulifolia [Poeppig] Kunze ex Gay, Fl. Chile **5**: 114 (1849), lapsus.

Dolia crassifolia [Poeppig] Kuntze, Rev. Gen. **3**: 216 (1898), lapsus.

Bargemontia crassulifolia (Poeppig) Johnston, Contr. Gray Herb. **85**: 107 (1929).

Alona tomentosa Lindley, Bot. Reg. **30**: sub tab. 46 (1844).—Type-material from cliffs near Valparaiso, *Bridges* and *Cuming 481*.

Alibrexia tomentosa (Lindl.) Miers, Hooker London Jour. Bot. **4**: 508 (Oct. 1845) and Ill. So. Am. Pl. **1**: 61 (1850); Gay, Fl. Chile **5**: 114 (1849); Dunal in DeCandolle, Prodr. **13**[1]: 17 (1852).

Dolia tomentosa (Lindl.) Bentham and Hooker, Gen Pl. **2**: 880 (1876); Reiche, Anal. Univ. Chile **125**: 504 (1910) and Fl. Chile **5**: 432 (1910).

Alibrexia rupicola Miers, Hooker London Jour. Bot. **4**: 506 (Oct. 1845) and Ill. So. Am. Pl. **1**: 59, tab. 11 (1850); Gay, Fl. Chile **5**: 114 (1849); Dunal in DeCandolle, Prodr. **13**[1]: 17 (1852).—Type collected at Concon by Miers.

Dolia rupicola (Miers) Bentham and Hooker ex Wettstein in Engler and Prantl, Nat. Pflanzenfam. iv. **3b**: 4 (1891).

Dolia grandiflora Philippi, Anal. Univ. Chile **91**: 44 (1895).—Type collected by Philippi on the coast near Concon.

CHILE: Along the coast near the sea from south of Valparaiso northward apparently to the port of Coquimbo, lat. 33° 35′ north to 30° S.

A prostrate shrub forming mats or draping rocks near the sea. It is well known from about Valparaiso and Concon, in fact all the four basic names of the species are founded on material from these localities. Plants, however, which seem to be referable to this species extend south at least to San Antonio, and Cartagena, and northward along the coast to the vicinity of Coquimbo. The southern collections are remarkable for their well developed pedicels, these regularly becoming 1–2 cm. long. Material from coastal rocks near Coquimbo is remarkably like this southern form, save only that its pedicels are short and only 3–5 mm. long. Werdermann (no. 886) has collected a peculiar form at Fray Jorge. This is a spreading shrub about 5 dm. tall and 10–15 dm. broad. The leaves are not spathulate as in other collections seen, but rather slender and linear, 15–25 mm. long and 1–1.5 mm. broad. The pedicels are 3–8 mm. long.

43. **Nolana incana** (Phil.), comb. nov.

Alibrexia incana Philippi, Fl. Atac. 45 (1860) and Viage Des. Atac. 18, 24, 25, 219 (1860).—Type collected near the coast at Paposo by Philippi.

Dolia incana (Phil.) Wettstein in Engler and Prantl, Nat. Pflanzenfam. iv. **3b**: 4 (1891); Reiche, Anal. Univ. Chile **125**: 503 (1910) and Fl. Chile **5**: 431 (1910).

Dolia eremobia Philippi, Anal. Univ. Chile **91**: 45 (1895); Reiche, Anal. Univ. Chile **125**: 503 (1910) and Fl. Chile **5**: 431 (1910).—Type collected at Breas by Larrañaga.

Bargemontia eremobia (Phil.) Johnston, Contr. Gray Herb. **85**: 107 (1929).

CHILE: Along the coastal plain and somewhat into the interior in the southwestern parts of the province of Antofagasta, from about Paposo south to the Sierra Esmeralda; lat. 25° south to somewhat beyond 25° 50′ S.

SPECIMENS EXAMINED: Paposo, *Philippi* (BD, G); vicinity of Paposo, gravelly slopes and benches facing sea, forming mats or rarely low-domed masses 1–3 m. broad, corolla white, variable in size and proportions, 1925, *Johnston 5569* (G); gravelly soil near mouth of Quebrada de San Ramon near Taltal, sprawling pallid shrub 15–45 cm. tall and 6–12 dm. broad, corolla yellowish, 1925, *Johnston 5128* (G); Breas, *Larrañaga* (MS, TYPE of *D. eremobia*); Posado Hidalgos, sprawling or prostrate in dry stream-ways, corolla yellowish, 1925, *Johnston 5662* (G).

A species much resembling *N. crassulifolia* but smaller throughout. In range *N. incana* is separated from its relative by several hundred kilometers of Chilean coast. The species is also related to *N. albescens* of the Copiapó area. From that species, no doubt its closest relative, it is separated by its prostrate rather than erect habit of growth.

44. **Nolana pallida** sp. nov.

Frutex prostratus pilis minutis stellatis abundantibus incanus e radice profunda valida oriens; ramulis rigidulis 2–15 cm. longis foliosis, internodiis 2–12 mm. longis; foliis spathulatis vel oblanceolatis 6–20 mm. longis 2–3 mm. latis congestis subfasciculatis crassiusculis compressis margine valde revolutis; pedicellis ad anthesin 1–3 mm. longis ascendentibus gracilibus, fructiferis 5–9 mm. longis plus minusve recurvatis rigidiusculis; calyce ad anthesin 5 mm. longo, tubo cupulare ad 2 mm. crasso, lobis cuneatis 2–3 mm. longis ascendentibus; calyce fructifero ca. 8 mm. longo subincrassato; corolla violaceo-coerulea anguste infundibuliformi 13–15 mm. longa extus puberula, tubo 1 mm. crasso ca. 3 mm. longo, lobis calycis subaequilongis intus sparse minuteque villosulis, faucibus ca. 6 mm. longis summum ad apicem ca. 5 mm. crassis; staminibus linearibus inaequalibus 2–4 mm. longis basim versus sparse villulosis; nuculis 5 uniseriatis late basaliterque affixis 2–2.7 mm. crassis depresse angulateque globosis.

PERU: Port of Chala, dept. Arequipa, prov. Camaná, lat. 15° 50′ S., prostrate shrub on sandy soil in Loma Formation, 230 m. alt., flowers bluish pink with violet throat, Nov. 26, 1915, *Weberbauer 7183* (TYPE, Herb. Berol.); Atico, dept. Arequipa, lat. 16° 10′ S., flowers violet-blue, Nov. 1863, *Raimondi 10971* (BD).

A very distinct species much simulating *N. crassulifolia* and allies of Chile in its gross habit, indument, and corolla-form, but differing in its blue rather than white corolla and in its unthickened and only sparsely pubescent filament-bases.

Another collection by Ramondi (no. 9086) may belong to *N. pallida*. This was collected Oct. 1863, only a short distance from Chala, at Atiquipa. The leaves are 3–6 mm. long. The single crushed and wrinkled corolla seems to be more broadly funnelform (ca. 1 cm. broad) than in *N. pallida* described above. Ramondi describes the corolla as blue with a dark violet throat. More and better material of this plant is needed.

45. **Nolana villosa** (Phil.), comb. nov.

Alibrexia villosa Philippi, Fl. Atac. 45 (1860) and Viage Des. Atac. 16, 38, 219 (1860).—Type collected near Breadal, ca. lat. 25° 27′ S., by Philippi.

Dolia villosa (Phil.) Reiche, Anal. Univ. Chile **125**: 503 (1910) and Fl. Chile **5**: 431 (1910).

Bargemontia villosa (Phil.) Johnston, Contr. Gray Herb. **85**: 112 (1929).

? Alona dubia Philippi, Anal. Univ. Chile **27**: 350 (1865) and Anal. Univ. Chile **91**: 37 (1895).—Type collected in Quebrada de Puquios by Geisse.

CHILE: Very arid gravelly places in the provinces of Atacama and Antofagasta, chiefly back from the coast, from about Chañarcillo, lat. 27° 50′ north to Aguada de Panulcito, lat. 24° 49′ S.

In addition to the material I have previously cited of this species, l. c., there may be added *Wedermann 403* from near Tierra Amarilla, and a collection from Chañarcillo which was received at Berlin from Philippi and determined by him as *A. dubia*. The species is remarkable for its copious spongy indument of slender soft dendritic hairs. The small corollas are white or rarely pink. The relations of this species are probably with *N. leptophylla*.

46. **Nolana lycioides** sp. nov.

Frutex ca. 1 m. altus laxe rigideque ramosus; ramis gracilibus divaricato-ramosis lignescentibus; ramulis foliosis gracilibus dense stipitato-glandulosis inconspicue hispidulis 2–6 cm. longis, internodiis 1–5 mm. longis; foliis spathulatis 5–9 mm. longis 0.5–0.9 mm. latis dense glandulosis saepe subfasciculatis ascendentibus vel divaricatis crassiusculis aliquantum compressis apice rotundis margine paullo vel vix revolutis; pedicellis 3–8 mm. longis gracillimis, fructiferis paullo accrescentibus ut videtur ascendentibus; calyce dense glandulifero ad anthesin 4 mm. longo in lobos cuneatos inaequales 2–3 mm. longos ascendentes usque ad 1 mm. supra basim dissecto, fructifero 6–7 mm. longo; corolla caerulea infundibuliformi 2.2–2.7 cm. longa extus sparse glandulosa et puberulenta intus in tubo minute puberulenta, tubo gracillimo 8(–10) mm. longo minus quam 1 mm. crasso calyce 2–3-plo longiori, faucibus abrupte ampliatis 10–12 mm. diametro, lobis ascendentibus rotundis 6–7 mm. latis 3–4 mm. longis sinibus clausis, limbo 18–20 mm. diametro; filamentis inaequalibus linearibus glabris summum ad apicem tubi affixis 5–7 mm. longis; nuculis 5–8 uniseriatis, maturis ignotis.

PERU: Gravelly places in the Loma Formation near Mollendo, Dept. Arequipa, lat. 17° S., 300 m. alt., shrub a meter high with bright blue corollas, Oct. 4, 1902, *Weberbauer 1517* (TYPE, Herb. Berol.)

A very distinct and well marked species characterized by its large corollas with very elongate and very slender tube and broad throat and limb, its slender pedicels, its small crowded very glandular leaves, and its slender but distinctly lignescent stiffish twiggy stems. The loosely branched habit of this plant is suggestive of a slender species of *Lycium*.

47. **Nolana deflexa** (Johnston), comb. nov.

Bargemontia deflexa Johnston, Contr. Gray Herb. **85**: 110 (1929).—Type collected at Carrizalillo by Harding.

CHILE: Known only from Carrizalillo, northern Atacama, a locality lying in lat. 26° S. and over 35 km. inland.

This species is evidently related to *N. clivicola* and *N. ramosissima* but quickly separated from them by its strongly deflexed fruiting pedicels, less slender proportionately stouter corollas, and very slender linear leaves. It further differs in being a species of the very arid country back from the coast and not of the hills along the sea. It occurs to the south of the two species mentioned.

48. **Nolana ramosissima** sp. nov.

Frutex densus globosus 9–16 dm. altus foliosissimus; ramulis numerosissimis gracilibus laxe ramosis cortice pallido obtectis pilis brevibus inconspicuis erectis simplicibus glanduliferis abundanter ornatis, internodiis 1–10 mm. longis; foliis abundantibus succulentis linearibus vel anguste spathulatis 5–13 mm. longis 0.5–1.1 mm. latis erectis vel ascendentibus glandulari-puberulentis apice rotundis margine leviter vel vix revolutis, costa vix evidente; floribus in axillis solitariis; pedicellis fructiferis 1–5 mm. longis erectis vel ascendentibus haud recurvatis; calycibus ad anthesin 8–10 mm. longis glanduloso-puberulentis, tubo cupulari 1.5–2 mm. longo ca. 2 mm. crasso, lobis linearibus erectis paullo inaequalibus; corolla azurea ca. 13 mm. longa extus pilis inconspicuis glanduliferis ornata intus basim versus inconspicue minutissimeque subglandulo-pubescente, tubo ca. 9 mm. longo infra medium 1 mm. crasso supra medium 1–1.5 mm. crasso lobis calycis subaequilongo, limbo ca. 7 mm. diametro infundibuliformi faucibus vix distincta lobis ascendentibus; filamentis inaequalibus filiformibus glabris 3–4 mm. supra basim corollae affixis; receptaculo lobato; nuculis 3–8 ellipsoidalibus vel ovoideis 2–3 mm. longis nigris ut videtur glutinosis.

Dolia salsoloides sensu auct.; Gaudichaud, Bot. Voyage Bonite, Atlas tab. 113 (1851–52); Philippi, Fl. Atac. 44 (1860) and Viage Des. Atac. 24, 25, 218 (1860); Reiche, Anal. Univ. Chile **125**: 505 (1910) and Fl Chile **5**: 433 (1910).

Bargemontia salsoloides sensu Johnston, Contr. Gray Herb. **85**: 111 (1929).

Chile: Coastal hills of the prov. Antofagasta; near Taltal, Paposo and probably Cobija, lat. 25° 25′ to 22° 30′ S.

Specimens examined: Paposo, *Philippi* (BD); about dry rocky slope at mouth of Quebrada de Guanillo near Paposo, a dense succulent globose bush 9–12 dm. tall, flowers blue, Dec. 8, 1925, *Johnston 5590* (type, Gray Herb.); rocky seaward slope at mouth of Quebrada de San Ramon near Taltal, a light green succulent bush 10–16 dm. tall, corolla light blue, Nov. 28, 1925, *Johnston 5167* (G).

A species closely related to *N. clivicola* but differing in being more succulent, less glandular, and more abundantly and densely branched. It is a dense globose bush with the leaves narrower, more juicy and of a lighter green than in its relative. Philippi collected this species at Paposo in December 1853 and determined it as *Dolia salsoloides*. This determination was subsequently accepted by Reiche. My collections of this plant came from the same area as Philippi's and were compared with them at Santiago. They were described under the name *B. salsoloides*. A recent study of the type of *Dolia salsoloides* Lindl., however, proves that plant to be a very different species. The present plant, which has been misdetermined in the writings of Philippi, Reiche and Johnston, is accordingly being described as a new species.

At present *N. ramosissima* is with certainty known only from Paposo and Taltal. Gaudichaud, l. c., however, has illustrated a plant which may represent our species, though the corolla-tube is shown more exserted and the calyx-tube much more developed than in any material I have seen. The details on Gaudichaud's plates, unfortunately, are frequently incorrect. I have seen no material in Europe which could possibly form the basis for this plate. I can only suggest that it may represent material collected by Gaudichaud at Cobija and that specimens should be looked for in the Webb Herbarium at Florence.

49. **Nolana clivicola** (Johnston), comb. nov.

Bargemontia clivicola Johnston, Contr. Gray Herb. **85:** 157 (1929).—Type from the hills near Tocopilla, *Johnston 6307*.

CHILE: Known only from the slopes above Tocopilla, prov. Antofagasta, ca. lat. 22° S.

SPECIMENS EXAMINED: Bush on rocky slope in Cereus-belt, Tocopilla, Oct. 18, 1925, *Johnston 6307* (G, TYPE); Tocopilla, 1930, *Jaffuel 1031* and *1032* (G).

Although described as having the corollas glabrous inside, a reëxamination of the type shows that the corolla-tube is minutely pubescent towards the base within.

50. **Nolana inconspicua** (Johnston), comb. nov.

Bargemontia inconspicua Johnston, Contr. Gray Herb. **85:** 158 (1929).—Type collected near Antofagasta, *Rose 19416*.

CHILE: Along the coastal hills of the province of Antofagasta, from Tocopilla to Antofagasta, lat. 22° south to 23° 40′ S.

SPECIMENS EXAMINED: Vicinity of Antofagasta, Oct. 31, 1914, *Rose 19416* (US, TYPE; NY); Cobija, *Gaudichaud* (Paris); coastal hills near Tocopilla, spreading shrub 3 dm. tall, corolla blue, Aug. 10, 1925, *Berninger 441* (BD); Tocopilla, Oct. 27, 1930, *Jaffuel 1016* (G).

The collections of Berninger and Jaffuel indicate that the corollas of this species may be as large as those in *N. leptophylla*. While I am unable to give satisfactory key-characters for the separation of *N. inconspicua* and *N. leptophylla* I am convinced that better and more ample collections of these two species will prove them amply distinct. The present plant seems to be a weaker less shrubby one than *N. leptophylla* and to have larger, more elongate, thinner leaves and a denser pubescence.

51. **Nolana leptophylla** (Miers), comb. nov.

Dolia leptophylla Miers, Hooker London Jour. Bot. **4:** 504 (Sept. 1845) and Ill. So. Am. Pl. **1:** 57 (1850); Dunal in DeCandolle, Prodr. **13**^{1}: 16 (1852).—Type given as from Peru, *Cuming 956*, but almost certainly from Cobija.

Bargemontia leptophylla (Miers) Johnston Contr. Gray Herb. **85:** 159 (1929).

Velpeaulia alibrexioides Gaudichaud, Bot. Voyage Bonite, Atlas tab. 109 (1851–52).—Type collected at Cobija by Gaudichaud.

Bargemontia alibrexioides (Gaud.) Johnston, Contr. Gray Herb. **85:** 159 (1929).

Alona deserticola Philippi, Fl. Atac. 44 (1860) and Viage Des. Atac. 89, 218 (1860); Reiche, Anal. Univ. Chile **125:** 500 (1910) and Fl. Chile **5:** 428 (1910).—Type material collected by Philippi at Chaco (3100 m. alt.), lat. 25° 15′ S., and Chañaral bajo (1500 m. alt.), lat. 26° 36′ S.

Bargemontia deserticola (Phil.) Johnston, Contr. Gray Herb. **85:** 111 (1929).

Chile: Dry gravels, mostly in the interior, of the provinces of Antofagasta and Atacama, lat. 22° 30′ south to 27° 10′ S.

Material examined: Cobija, July 1836, *Gaudichaud 6* (Paris); "Cobija, Iquiqui et Arica." 1831, *Cuming 956* (K, type); Atacama, *Philippi* as *A. deserticola* (BD); Quebrada de Pasto Cerrado near Potrerillos, prostrate perennial on dry gravelly bench, corolla slightly bluish, 2100 m. alt., Oct. 1925, *Johnston 3663* (G, K); between Puquios and La Puerta, Quebrada de Puquios, Cord. Maricanga, flowers bluish, 1500 m. alt., Oct. 1924, *Werdermann 454* (G, BD).

The type of *N. leptophylla* is *Cuming 956* in the Hooker collections at Kew. It was labeled by Hooker as from Peru but according to a manuscript plant-list at the British Museum and to one of Cuming's original labels which is associated with this same number in the Bentham collections at Kew, it is clear that the specimen belongs to a suite of numbers that Cuming distributed as from "Cobija, Iquiqui et Arica." The type no doubt came from Cobija.

The type of *Velpeaulia alibrexioides*, as shown by specimens at Paris, is in all probability Gaudichaud no. 6 from Cobija. This specimen in its rigid branching, thick strongly revolute leaves, and stiff glandular hairs gives every evidence of having grown in an extremely arid situation. The type of *N. leptophylla*, which I believe we may accept as having been also collected at Cobija, is a much more slender plant with much longer and much more slender hairs. The differences between the two types, I am convinced, are ecological in origin. Cuming's plant is very much like the more southerly plants from the interior, along the base of the cordilleras, which Philippi has described as *Alona deserticola*.

Werdermann's material (no. 454) from between Puquios and La Puerta is notable for having some forked hairs intermixed with the simple hairs forming the mass of its indument. Typically *N. leptophylla* has entirely simple hairs. Werdermann's specimen, as well as similarities in the shape of the revolute leaves found between *N.*

leptophylla and *N. villosa,* makes me feel that these two species are immediately related. Both are plants inhabiting the arid crests (above the fog-bathed fertile slopes) of the coastal hills as well as the desert interior. Except for the collections near Cobija, which may have come from the arid crests of the coastal hills at 1000 m. or over, *Nolana leptophylla* is known only from the very arid interior, 75–125 km. from the coast and at altitudes from 1500 m. to over 3000 m.

52. **Nolana sedifolia** Poeppig

Nolana sedifolia Poeppig in Froriep, Notizen **23**: 276 (1829).—Type collected on the coast at Concon by Poeppig, no. 68.

Bargemontia sedifolia (Poepp.) Johnston, Contr. Gray Herb. **85**: 110 (1929).

Fabiana lanuginosa Hooker and Arnott, Bot. Beechey Voyage 35 (1830); Miers, Hooker London Jour. Bot. **5**: 164 (1846) and Ill. So. Am. Pl. **1**: 88 (1850).—Type from Coquimbo.

Salsola glomerulata Meyen, Reise **1**: 375 (1834).—Type collected by Meyen near the Port of Copiapó.

Dolia vermiculata Lindley, Bot. Reg. **30**: sub tab. 46 (1844); Miers, Hooker London Jour. Bot. **4**: 502 (Sept. 1845) and Ill. So. Am. Pl. **1**: 55, t. 12 (1850); Gay, Fl. Chile **5**: 108 (1849); Gaudichaud, Bot. Voyage Bonite, Atlas tab. 112 (1851–52); Dunal in DeCandolle, Prodr. **13**[1]: 15 (1852); Reiche, Anal. Univ. Chile **125**: 502 (1910) and Fl. Chile **5**: 430 (1910).—Type-material cited as "Coquimbo, (herb. Cuming, 893; Bridges, 1336)"; Bridges collections came from between Huasco and Coquimbo!

Dolia verticillata Miers ex Walpers, Anal. **1**: 523 (1848–49), lapsus calami.

Alibrexia brevifolia Philippi, Linnaea **33**: 208 (1864).—Type collected by Landbeck on rocks near sea at Los Molles.

Dolia brevifolia (Phil.) Philippi ex Wettstein in Engler and Prantl, Nat. Pflanzenfam. iv. **3b**: 4, fig. 1 (1891).

Alibrexia breviflora Philippi ex Johnston, Contr. Gray Herb. **85**: 107 (1929), lapsus calami.

CHILE: Dry rocky places near the sea from the vicinity of Valparaiso north to Iquique, lat. 33° to 20° 13′ S.

A very well marked species forming a shrub 5–12 dm. tall. The corolla is white. The small fleshy leaves are glabrous or nearly so above, but are villous-tomentose beneath on the parts not covered by the strongly revolute margins. The only species readily confused with *N. sedifolia* is *N. diffusa,* a local species occurring in the coastal area with *N. sedifolia* in the northernmost parts of its range. *Nolana diffusa,* however, is a low spreading plant with bluish corollas, a looser sordid tomentum and narrower tomentose leaves. The remarkably extended range of *N. sedifolia,* between Valparaiso and Iquique is well substantiated by numerous collections.

With the exception of Philippi's *Alibrexia brevifolia* the type of all the species cited above have been examined. The original collection of *Salsola glomerulata,* unrecognized since it was described in 1834, was found among the undetermined Chenopodiaceae at Berlin. It is a weathered and sterile specimen of the present plant! According to the label it was collected April 18, 1831 at "Copiapo." The original publication of the species makes it clear, however, that it was found in the immediate vicinity of the old port of Copiapó (a few kilometers to the south of Caldera) and must have been collected in March 1831.

When Lindley described *D. vermiculata* he cited two specimens, giving both as from Coquimbo, first, *Cuming 893,* and second, *Bridges 1336.* The Cuming specimen may be accepted as from Coquimbo for the species has been collected by numerous other botanists in that locality. Bridges' material, however, did not come from Coquimbo. Lindley gives the number of the Bridges collection as 1336. This is clearly an error for 1330! Bridges' no. 1336 belongs with a specimen of *Dondia multiflora* Phil. from salt marshes near Huasco and Copiapó. In Bridges' manuscript plant-list at the British Museum his no. 1330 is accompanied by an unpublished name suggesting the similarity of the plant with *Fabiana,* and by data indicating that it was a white-flowered shrub, 3–9 dm. tall, growing near the coast between Huasco and Coquimbo. It is obvious that this data fits *N. sedifolia* and that it is quite inapplicable to any other one of the nine Nolanaceae collected by Bridges. In the Hooker collections at Kew the species appears under Bridges' number 1331 and is labeled as from Concepcion. The geographic data is clearly false. Bridges' plant-list shows that no. 1331 belongs to a *Phrodus.* At Paris *N. sedifolia* occurs under its proper number, i. e. 1330. Miers, Ill. So. Am. Pl. **2**: 25, adnot. (1857), has given a discussion of this confusion among Bridges' numbers and has also accepted *Bridges 1330* as the proper designation for the cotype of Lindley's species.

The original description of *A. brevifolia* seems to indicate the present species. It seems significant also that Wettstein has bracketed it with *D. vermiculata* and that material of *N. sedifolia* from Valparaiso area has been distributed from Santiago under Philippi's binomial. It becomes very perplexing, therefore, to note that Reiche, Fl. Chile **5**: 431 (1910), treats *A. brevifolia* as a synonym of *Dolia incana,* one of the stellate-tomentose species belonging to the group of *N. crassulifolia.*

53. **Nolana diffusa** sp. nov.

Planta fruticosa depressa 5–15 cm. alta 30–90 cm. lata ramosissima; ramulis gracilibus 3–15 cm. longis 1–2 mm. crassis plus minusve glandulosis pilis gracilibus 1–2 mm. longis indumentum laxissime tomentosum formantibus vestitis, internodiis 2–4(–6) mm. longis; foliis numerosissimis oblongis vel spathulato-oblongis 2–4 mm. longis 1–1.5 mm. latis succulentis ascendentibus vel divaricatis non rariter suboppositis sparse glandulosis pilis longis flexuosis vestitis; foliis juventate (in axillis foliorum et apicem versus ramulorum) fasciculos densos conspicue tomentosos formantibus; pedicellis 1–3 mm. longis laxe sparseque tomentosis ascendentibus maturitate recurvatis; calycibus ad anthesin 3–4 mm. longis 2 mm. crassis usque ad medium lobatis, lobis crassis oblongis vel oblongo-lanceolatis pilis flexuosis vestitis; calycibus fructiferis 5 mm. crassis; corolla coerulescente saepissime ca. 6 mm. longa quam calyce duplo longiore (rariter ad 10 mm. longa et quam calyce triplo longiore), tubo intus basim versus sparse villosulo, limbo 5–6 mm. diametro; filamentis linearibus inaequalibus 3–5 mm. longis; nuculis uniseriatis 3–7 plus minusve globosis ca. 2 mm. diametro nigris minute tuberculatis anguste irregulariterque rugulosis.

CHILE: Very arid gravels on the high crests and along the dry bases of the coastal hills of the province of Antofagasta (Caleta Encalada, Miguel Diaz, Paposo and Taltal), lat. 24° 23′ to 25° 25′ S.

SPECIMENS EXAMINED: Caleta Encalada, June 1923, *Harding* (G); dry crests well above the fertile belt, Aguada de Miguel Diaz, forming depressed mats 3–9 dm. broad and 5–15 cm. high, corolla lavender, Dec. 1925, *Johnston 5384* (TYPE, Gray Herb.); gravelly coastal plain, Paposo, prostrate 3–6 dm. broad and 6–15 cm. high, corolla pale bluish, Dec. 1925, *Johnston 5570* (G); Taltal, Nov. 1930, *Jafful 960* (G).

A species related to *N. tocopillensis* but differing in its smaller corollas, smaller more congested much less glandular leaves, and very much more dense and branched habit. In another paper, Contr. Gray Herb. **85**: 110 (1929), I have treated the plant as a form of *N. sedifolia.* The colored corollas, the narrower tomentose leaves, and the sordid tomentum, however, readily separates *N. diffusa* from the erectly growing much more shrubby *N. sedifolia.*

54. **Nolana foliosa** (Phil.), comb. nov.

Dolia foliosa Philippi, Cat. Pl. Itin. Tarapaca 68 (1891); Reiche, Anal. Univ. Chile **125**: 504 (1910) and Fl. Chile **5**: 432 (1910).—Type collected between Mocha and Guaviña by Rahmer in March 1885.

Bargemontia foliosa (Phil.) Johnston, Contr. Gray Herb. 85: 111 (1929).

Chile: Known only from the Quebrada de Tarapacá between Mocha and Guaviña, 2000–2500 m. alt., ca. lat. 19° 48′ S. and long. 69° 15′ W., in the province of Tarapacá about a 100 km. inland.

I have studied specimens at Washington, Kew and Berlin which were received from Philippi. These collections, obviously part of a single gathering, were received as "*Dolia foliosa* Phil." and given as from "Tarapacá." More and better collections of the species are needed, however, before its relations can be satisfactorily determined. The isotypic material examined suggests affinities with *N. confinis* and *N. tocopillensis.* The branching is rather regularly dichotomous. The corolla is smaller, the leaves are less densely fasciculate, and the stems are less evidently nodose than in the species mentioned. Some of the glabrescent forms of *N. confinis* seem to approach *N. foliosa* rather closely. Both *N. foliosa* and *N. confinis* are species of the interior.

55. **Nolana tocopillensis** (Johnston), comb. nov.

Bargemontia tocopillensis Johnston, Contr. Gray Herb. **85:** 158 (1929).—Type collected on a hillside near Tocopilla, *Johnston 3603.*

Chile: Coastal hills in northwestern part of the province of Antofagasta, lat. 21° 25′ south to 22° 30′ S.

Specimens examined: Sobre los Cerros de los Paredones en las orillas de "Loa," lat. 21° 25′ S., *Raimondi 10285* (BD); Tocopilla, Oct. 1930, *Jaffuel 1022* (G); slopes in the fertile belt near Tocopilla, Oct. 1925, *Johnston 3603* (G, type); Cobija, *Gaudichaud 4* and *5* (Paris).

The leaves are glandular and are somewhat thickened at the attachment. They are spreading and slightly recurved beyond the middle or the whole leaf in lateral outline may present a characteristic flattened sigmoid curve.

56. **Nolana confinis** (Johnston), comb. nov.

Bargemontia confinis Johnston, Contr. Gray Herb. **85:** 176 (1929).—Type collected at Candarave, *Weberbauer 7382.*

Peru: Base of the cordilleras in the department of Tacna, 30–125 km. inland, 500–4000 m. alt., lat. 17° to 18° S.

Specimens examined: On bare sandy hills near Tacna, 800–900 m. alt., 1891–1892, *Woitschach* (BD); a single plant on bank of nearly dry stream-way near Tacna, 650 m. alt., corolla bluish, Aug. 1925, *Werdermann 720* (G, BD, FM); sand in stream-way near Tacna, corolla sky-blue, 1891, *Woitschach* (BD); dry hills, Tacna, plant prostrate, Sept. 1864, *Pearce* (K, BM); with scattered herbs and

Cereus, Candarave, 4000 m. alt., corolla violet, March 1925, *Weberbauer 7382* (FM, TYPE; G, BD); ? Altos de Sitana near Valle de Locumba, 1500 m. alt., on sand, *Woitschach* (BD).

The fruit of this species consists of 5 more or less roughened and angulate nutlets. These are affixed on a low but distinct pyramidal gynobase which occupies most of the receptacle. The type-collection of *N. confinis* is undoubtedly a perennial plant. Other collections, however, appear to be small herbaceous annuals. The plants probably flower the first year, and, when conditions are favorable, develop the more or less persistent root and shrubby base that is to be observed in various degrees of development among the specimens before me. The small leaves are fasciculate and usually more or less embedded in a floc of wooly hairs. These characters suggest relations with *N. sedifolia, N. diffusa* and *N. tocopillensis*. The specimens I have cited from the Altos de Sitana are peculiar in having an indument of numerous minute curved hairs. They do not have the characteristic tomentum of good *N. confinis*. In addition the leaves are several millimeters broad and are not distinctly fasciculate. The specimens are left in *N. confinis* somewhat doubtfully. They probably represent an undescribed species.

57. **Nolana pilosa** sp. nov.

Suffrutex diffusus, partibus junioribus sparse glandulosis pilis simplicibus mollibus flexuosis 1–2 mm. longis ornatis pilosis vel subtomentosis; partibus maturis non rariter plus minusve subglabratis; caulibus prostratis vel laxe decumbentibus e radice recta per paucos annos persistente orientibus laxe ramosis 1–10 dm. longis gracilibus 1.5–3 mm. crassis, internodiis 0.5–6 cm. longis; foliis valde compressis 1–2.7 cm. longis 1–6(–8) mm. latis saepissime oblanceolatis vel sublinearibus (vetustioribus non rariter late affixis et oblanceolato-oblongis) apicem versus latioribus basim versus in petiolum gracilem gradatim attenuatis margine revolutis apice obtusis vel rotundis; pedicellis ad anthesin 5–15 mm. longis ascendentibus, fructiferis recurvatis incrassatis sed paullo longioribus; calyce ad anthesin 6–8 mm. longo, tubo cupulato, lobis erectis inaequalibus cuneatis 4–6 mm. longis 1–2 mm. latis; corolla azurea infundibuliformi 13–22 mm. longa, quam tubo calycis breviore intus minute puberulento, limbo 12–22 mm. diametro, lobis ascendentibus rotundis; staminibus inaequalibus 5–8 mm. longis; nuculis 4–8 uniseriatis inaequalibus depresse globosis rugulosis angulatis 2–2.5 mm. crassis.

PERU: Known only from the coastal hills in the region about Mollendo, dept. Arequipa, lat. 17° S.

SPECIMEN EXAMINED: Mollendo, dept. Arequipa, in dry gravel at lower edge of the Loma Formation, 20–100 m. alt., flowers sky-blue, Oct. 2, 1902, *Weberbauer 1485* (BD); Mollendo, dry gravel at lower edge of the Loma Formation, 100–200 m. alt., flower bluish, Oct. 8, 1902, *Weberbauer 1556* (BD); Mollendo, *Safford K. 65* (K); Mejia near Mollendo, 50 m. alt., Nov. 16, 1923, *Guenther and Buchtien 117* (TYPE, Hamburg); Mejia, 40 m. alt., Oct. 27, 1923, *Guenther and Buchtien 119* (Hamb.); Cachendo, east of Mollendo, 1000 m. alt., Nov. 27, 1923, *Guenther and Buchtien 118* (Hamb.); Cachendo, 1000 m. alt., Oct. 15, 1923, *Guenther and Buchtien 122* (Hamb.).

A loosely branched prostrate plant with stems becoming almost a meter long. It is distinctly coarser than *N. confinis* having larger broader leaves, larger and broader corollas, and less entangled hairs in its indument. As is the case with *N. confinis* it may flower the first year and so appear to be annual. It frequently does persist, however, and produce a thickened root that probably lasts a number of years. In what I consider the typical form, the pilosity is more or less distinctly spreading. In *Weberbauer 1556* from Mollendo and *Guenther and Buchtien 118* from Cachendo, the pilosity is dense and appressed on the leaves thus making them tomentose. These two collections, however, are obvious xerophytes and very much less thrifty than the plants having the typical spreading pilosity described. The difference I believe is ecological in origin. The four collections by Guenther and Buchtien (nos. 117, 118, 119 and 122) are the basis upon which Bruns, Mitt. Inst. Bot. Hamburg **8**: 71 (1929), reports *Alona coelestis, A. deserticola, A. xerophila* and *Dolia tarapacana* from the Peruvian littoral.

Questionable and excluded Species

Alona microphylla Miers, Hooker London Jour. Bot. **4**: 501 (Sept. 1845) and Ill. So. Am. Pl. **1**: 54 (1850); Gay, Fl. Chile **5**: 112 (1849). *Nolana microphylla* Miers ex Dunal in DeCandolle, Prodr. **13**^{1}: 15 (1852).

As indicated by Reiche, Fl. Chile **5**: 320 (1910), this is the Solanaceous *Phrodus microphyllus* Miers, Ann. and Mag. Nat. Hist. ser. 2, **4**: 33 (1849) and Ill. So. Am. Pl. **2**: 24, tab. 42 (1857). It was originally given as based upon *Bridges 1330* from Concepcion, in southern Chile, but as Miers later suggested all this data is incorrect. A study of Bridges' plant-list shows conclusively that this *Phrodus* should bear the number *1331* and that it was collected in a dry valley between Huasco and Copiapó in the province of Atacama. It is given by Bridges as being a shrub 2–3 ft. high and as having white flowers.

Nolana fruticosa Young, Hort. Epsom. **1**: 34 (1828), nomen.

This name appears without any descriptive matter in the above cited list. Loudon, Gard. Mag. **5**: 471 (1829), attributes the name to George Penny who was gardener at the Young's Epsom Nursery but whose name is not mentioned in the Hortus Epsomensis, and gives the following data regarding the species. "Nolana (L.) fruticosa Penny in Hort. Eps. p. 34 (tenella Lindl. Hort. Trans. vol. vii. part ii. p. 252) Mr. Lindley erroneously considers this plant an annual. It has remained perfectly shrubby, for several years, in a greenhouse, to which it is no common ornament: hence I have retained the above original and expressive name."

Nolana revoluta Ruiz and Pavon, Fl. Peruv. et Chile. **2**: 8, tab. 113b (1799); G. Don, Gen. Syst. **4**: 479 (1837). *Alona revoluta* (R. and P.) Lindley, Bot. Reg. **30**: sub tab. 46 (1844); as to name only. *Alibrexia revoluta* (R. and P.) Miers, Hooker London Jour. Bot. **4**: 508 (Oct. 1845) and Ill. So. Am. Pl. **1**: 61 (1850); Dunal in DeCandolle, Prodr. **13**^{1}: 17 (1852); as to name only. *Dolia revoluta* (R. and P.) Bentham and Hooker, Gen. Pl. **2**: 880 (1876). *Nolana conferta* Ruiz and Pavon, Fl. Peruv. et Chile. **2**: 7 (1799).

This plant is based upon a plate, the identification of which remains doubtful. The source and basis of the species is given as "arenosis locis ad Camanae Provinciam, unde Tafalla iconem nobis misit." Miers identified the species with the plant from about Lima which I am treating as *N. Gayana.* That plant however, differs in habit of growth, shape and lack of veining of the leaves, long pedicels, etc. The only other Peruvian plant at all suggestive of *N. revoluta* is the one I am describing as *N. pallida,* which incidentally does come from the province of Camaná, but that plant differs in shape of corolla, the very different calyx, its strong perennial root, very woody stems, not evidently veined leaves, etc. Both *N. Gayana* and *N. pallida* have a dense felt-like indument of stellate hairs. *Nolana inflata* is described and illustrated as glabrous. After puzzling over this species for many months I have come to believe that the plant either has not been recollected or represents a non-Nolaneaceous plant.

Nolana tenella Lindley, Trans. Hort. Soc. London **7**: 252 (1828); G. Don. Gen. Syst. **4**: 479, fig. 43 (1837); Dunal in DeCandolle, Prodr. **13**^{1}: 10 (1852); Saunders, Jour. Genetics **29**: 387–419, tab. 33–36 (1934). *? Nolana paradoxa* var. *violacea* hort., l'Hort. franç. **1859**: 60, tab. 6 (1859), not Van Houtte (1858).

This species is of garden origin and apparently a chance hybrid of *N. humifusa* of Peru and *N. paradoxa* of Chile. It was originally described by Lindley from material "Presented to the [London Horticultural] Society, in 1824, by Robert Barclay, Esq. by whom it was raised from Chilian seeds." It is said to have flowered in the garden of the Society at Chiswick in August, 1825. Lindley's paper concerning it was read in September 1827 and published the following year. Of *N. tenella* I have studied material in the Bentham collections at Kew labelled, "*Nolana tenella,* Hort. Barclay 15-7-30" and quite similar collections at Geneva labeled "*Nolana tenella,* du Perou, Jardin de M. Barclay, Juill. 1830, M. Alphonse DC." These two collections agree closely with the original description and are, I believe, authentic representatives of the species. They are evidently hairy, especially on the stems, petioles and pedicels where the slimy spreading hairs are at least one millimeter long. Other material that I am content to refer to *N. tenella* is practically glabrous. This is the condition in the specimens at Washington distributed from St. Petersburg garden as this species, and in the material at the Gray Herbarium which was grown in the Harvard gardens in 1865 (as *N. prostrata*).

When he described *N. tenella,* Lindley remarked "This very pretty species has been confounded in the Botanical Magazine, tab. 2604 with my *Nolana paradoxa,* an extremely curious and widely different plant." This ambiguous remark by Lindley has resulted in much confusion. The plant illustrated on plate 2604 (as I have fully discussed under *N. paradoxa*) is characteristic *Nolana paradoxa* of Chile and not representative of *N. tenella* as so many authors have supposed. Only the observations in the text accompanying this plate apply to *N. tenella!* Very significant is the following final paragraph in the Botanical Magazine, "Our drawings were taken at the collection of the late John Walker, Esq. in May, 1823, where it was raised from seeds, imported from Chili, by Mr. Francis Place [who had also imported the seeds from which the type of *N. paradoxa* was grown]. But we had no opportunity of examining the plant particularly, and comparing it with *prostrata,* till we received specimens of both species from Bury Hill in August [1824] last." It is to be noted that Bury Hill was the estate of Robert Barclay and the place from which the Chiswick plants described by Lindley as *N. tenella* were also obtained. What is more, the material studied by Lindley and by the editor of the Botanical Magazine seems to be part of the same distribution, for both authors mention August 1824 as the date upon which their material from Barclay's garden came to hand. The material from Barclay grown in the Chiswick gardens was described as *N. tenella* by Lindley. That received by the editor of the Botanical Magazine was misidentified with *N. paradoxa,* associated with a plate of that species, and discussed at length in the text where it was compared with *N. prostrata* of Peru.

The status of *N. tenella* has recently been well established through breeding experiments conducted by Saunders, Jour. Genetics **29:** 387–419 (1934). She has demonstrated that it is "not a species but the F_1 hybrid between prostrata ♀ and atriplicifolia ♂" and has given some excellent colored plates showing the parents as well as the hybrid. Her *N. atriplicifolia* I consider to be a form of *N. paradoxa* Lindl. *Nolana prostrata* is a synonym of *N. humifusa.* Miss Saunders believes *N. tenella* to be a natural hybrid. As I have discussed under *N. paradoxa,* however, the distribution of the two parents is such that a wild hybrid is out of the question. *Nolana tenella* must have had a garden origin.

Osteocarpus ? elegans Philippi, Anal. Univ. Chile **91:** 38 (1895).

This name is mentioned in the discussion following the original description of *Alona ? grandiflora* (which appears to be a synonym of *Alona carnosa* Lindl.) as follows (translated). "The plant which most approximates it, is *Osteocarpus ? elegans,* from which *A. ? grandiflora* differs in having the stems and leaves coarser, the calyx twice as large, and the younger parts covered with abundant varnish." Possibly Philippi was referring to some form of *Alona rostrata.* Reiche, in his Flora de Chile, makes no mention of the name.

INDEX TO BOTANICAL NAMES

Alibrexia, 11, 23
breviflora, 75
brevifolia, 75, 76
Gayana, 33
incana, 68
revoluta, 33, 81
rupicola, 23, 68
tomentosa, 68
villosa, 70
Alona, 3, 8, 11, **17**, 21
baccata, 14, 37
balsamiflua, 17, **21**
caelestis, 21
carnosa, 6, 14, 17, **19**, 83
Chastenayana, 20
coelestis, 14, 17, **21**, 38, 80
deserticola, 74, 80
dubia, 70
ericifolia, 14, 21, 38
filifolia, 17, **20**
flaccida, 60
floribunda, 21
Fonckii, 18
glandulosa, 20
grandiflora, 19, 83
lepidophylla, 18
longifolia, 41
micrantha, 63
microphylla, 80
Miersii, 18
mollis, 61
obtusa, 14, 18, 19
patula, 60
phylicifolia, 18
pusilla, 57
revoluta, 81
rigida, 63, 64
rostrata, 14, **17**–19, 83
sedifolia, 19
sphaerophylla, 65
stenophylla, 17, **22**
tomentosa, 68
vernicosa, 19
xerophila, 63, 80
Aplocarya, 11, 23
divaricata, 23, 64
Atropa gymnosperma, 51, 53
humifusa, 23, 50, 52, 53
physalodes, 53
Bargemontia, 9, 11, 23
albescens, 66
alibrexioides, 74
Bargemontia (*Continued*)
aplocaryoides, 57
clavata, 65
clivicola, 73
confinis, 78
crassulifolia, 68
deflexa, 71
deserticola, 74
divaricata, 64
eremobia, 69
flaccida, 60
foliosa, 77
glauca, 66
gracillima, 59
inconspicua, 73
leptophylla, 73
linearifolia, 62
micrantha, 63
mollis, 61
peruviana, 23, 66
platyphylla, 60
salsoloides, 63, 72
sedifolia, 75
sphaerophylla, 65
tarapacana, 61
tocopillensis, 78
villosa, 70
Belladona peruviana, 51
Boraginaceae, 1, 4
Cacabus inflatus, 49
Convolulaceae, 1–4
Convolvulus, 21
filifolius, 20
linifolius, 20
Dichondra, 16
Dolia, 9–11, 23
albescens, 66
brevifolia, 75
canescens, 66
clavata, 7, 14, 63–65
var. puberula, 63
crassifolia, 68
divaricata, 7, 64
eremobia, 24, 69
foliosa, 77
grandiflora, 68
hirsutula, 63, 64
incana, 69, 76
laxa, 59
leptophylla, 15, 73
macrocalyx, 61
macrocarpa, 66

Dolia (*Continued*).
micrantha, 63
puberula, 63
revoluta, 81
rupicola, 57, 68
salsoloides, 62, 72
tarapacana, 61, 80
tomentosa, 68
vermiculata, 23, 75
verticillata, 75
villosa, 70
Eunolana, 10
Fabiana, 2
grandiflora, 20
lanuginosa, 75
Falkia, 16
Grabowskia, 4, 16
Gubleria, 24
baccata, 24, 37
Ipomoea Cruckshanksii, 20
Labiatae, 4
Leloutrea, 24
aplocaryoides, 24, 57
Lycium, 2, 4
Neudorffia, 22
peruviana, 51
Neudorfia, 22, 53
Nicandra, 2, 4
Nolana, 2, 3, 8, 10, 11, 17, **22**, 51
acuminata, 6, 25, 39–41, **42**
Adansoni, 10, 25, **47**
alba, 37
albescens, 27, **66**, 67, 69
angustifolia, 42
aplocaryoides, 9, 26, **57**, 58
arenicola, 24, **29**
atriplicifolia, 43, 45–47, 83
var. cuneifolia, 44
var. subcorulea, 44
baccata, 3, 25, 35, 36, **37**
bipartita, 29
bracteosa, 41
caelestia, 21
carnosa, 19
Carrera, 37
Carrerae, 37
var. leucantha, 37
Chastenayana, 20
clivicola, 28, 71–**73**
coelestis, 21
conferta, 81
confinis, 6, 9, 29, **78**, 80
cordata, 48
coronata, 23, 26, **55**
crassulifolia, 5, 6, 9, 23, 27, 66, **67**, 69, 70, 76
debilis, 36
Nolana (*Continued*).
decemloba, 62
deflexa, 28, **71**, 75
diffusa, 28, **77**, 79
divaricata, 27, 28, 63, **64**, 66
elegans, 25, **40**
ericifolia, 21
filifolia, 20
flaccida, 6, 8–10, 27, **60**
foliosa, 6, 28, **77**
fruticosa, 80
galapagensis, 5, 6, 9, 24, **32**
gallinacea, 51
Gayana, 3, 5, 9, 24, **33**, 34, 81
geminiflora, 44
glandulosa, 20
glauca, 27, **66**
glutinosa, 41
gracillima, 6, 9, 26, **59**, 60
grandiflora, 42, 43
grossulifolia, 68
Guentheri, 26, **55**
humifusa, 3, 5, 10, 22, 26, 33, 45, 46, **50**, 55, 56, 81, 83
incana, 24, 27, 67, **68**
inconspicua, 28, **73**
inflata, 5, 10, 23, 26, **49**, 81
insularis, 5, 25, **49**
intonsa, 9, 24, 33, **34**
Jaffuelii, 5, 25, **39**
lanceolata, 41–43
latipes, 24, **30**, 32
laxa, 5, 7, 9, 26, 33, **59**
lepidophylla, 18
leptophylla, 6, 9, 24, 28, 70, **73**
leucantha, 37
linearifolia, 9, 10, 27, **62**
linearis, 37
littoralis, 44
longifolia, 41
lycioides, 9, 28, **70**
microphylla, 80
mollis, 8–10, 27, **61**
napiformis, 42
Navarri, 37
obtusa, 18
ochrocarpa, 44
pallida, 28, **69**, 81
pallidula, 9, 24, **31**
paradoxa, 3, 5, 6, 10, 23, 25, 31, **43**, 81–83
var. glaberrima, 44
var. violacea, 44, 81
parviflora, 25, **35**, 51
Pearcei, 26, **58**
peruviana, 27, 61, **66**
petiolata, 44

Nolana (*Continued*).
pilosa, 9, 29, **79**
platyphylla, 6, 27, **60**
plicata, 26, **55**
polymorpha, 13, 26, **56**
prostrata, 22, 23, 30, 45, 47, 50, 56, 82, 83
pterocarpa, 24, 25, **36**
pterosperma, 36
pulchella, 36
ramosissima, 28, 64, **71**
revoluta, 23, 29, 33, 81
rostrata, 18
rupestris, 42
rupicola, 5, 6, 25, **40**, 43
salsoloides, 27, **62**–65
sedifolia, 5, 6, 14, 23, 28, **75**, 77, 79
sessiliflora, 24, **34**
sessilifolia, 34
spathulata, 23, 24, **29**, 30
stans, 37
stenophylla, 22
tarapacana, 6, 9, 10, 27, **61**
tenella, 45–47, 81–83
thinophila, 6, 8, 10, 26, 44, **56**
tocopillensis, 28, 77, **78**, 79
triquetra, 41
ventricosa, 49
villosa, 6, 28, **70**, 75
Weberbaueri, 5, 26, **58**, 59
Werdermannii, 27, **67**
Nolana §Alona, 17
§Eunolana, 23
§Pteronolana, 24, 36
§Sorema, 23
subgen. Gastrina, 23
subgen. Iohypa, 23
subgen. Periesta, 23
subgen. Spatulina, 23
Nolanaceae, **16**
Nolanales, 16
Nolaneae, 16
Nolanidae, 16
Nolanidia, 16
Nolanieae, 16
Nolanineae, 16
Osteocarpus, 17
brevifolius, 18
clavatus, 65
elegans, 83
foliolosus, 20
lepidophyllus, 18
Osteocarpus (*Continued*).
rostratus, 18
spathulatus, 63, 64
Pachysolen, 24
Periloba, 10, 23
baccata, 37
galapagensis, 32
insularis, 49
longifolia, 40, 41
paradoxa, 43
parviflora, 35
pterosperma, 36
sessiliflora, 34
stans, 37
Petunia, 2
Phrodus, 4
microphyllus, 80
Rayera, 17
teretifolia, 17, 18
Rubiaceae, 48
Salsola glomerulata, 75
Siphonanthus, 16
Solanaceae, 1–5, 7, 8
Sorema, 9, 10, 23
acuminata, 14, 42
atriplicifolia, 43
bracteosa, 41
cordata, 47
elegans, 40
glutinosa, 41
lanceolata, 39, 41, 42
linearis, 14, 37
litoralis, 43
littoralis, 43
longifolia, 41, 42
paradoxa, 43
var. atriplicifolia, 43
parviflora, 35
petiolata, 44
Swingera, 23
Teganium, 23
procumbens, 51, 53
Triguera, 16
Tuba, 22
Tula, 22, 48, 53
Adansoni, 22, 47
Velpeaulia, 24
alibrexioides, 24, 74
Verbenaceae, 4
Walkeria, 23, 53
Zwingera, 23, 52, 53
humifusa, 50